

**UNITED STATES
DEPARTMENT OF THE INTERIOR
HAROLD L. ICKES, SECRETARY**

**BUREAU OF MINES
R. R. SAYERS, DIRECTOR**

INFORMATION CIRCULAR

HIGH-GRADE DOLOMITE DEPOSITS IN THE UNITED STATES



BY

JOHN H. WEITZ

JOHN H. WEITZ

INFORMATION CIRCULAR

UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

HIGH-GRADE DOLOMITE DEPOSITS IN THE UNITED STATES^{1/}

By John H. Weitz^{2/}

CONTENTS

	<u>Page</u>		<u>Page</u>
Introduction	2	Wisconsin.....	35
Definition	2	Table of analyses.....	37
Occurrence.....	3	Ohio.....	43
New England area	3	Table of analyses.....	47
Vermont	3	Central States.....	61
Massachusetts.....	4	South Dakota	61
Connecticut.....	4	Minnesota.....	61
Southeastern New York.....	5	Iowa.....	62
Maine.....	5	Missouri.....	63
Table of analyses.....	6	Kansas.....	64
Eastern and Southeastern States	8	Arkansas.....	64
New Jersey.....	8	Oklahoma.....	64
Pennsylvania.....	9	Texas.....	65
West Virginia.....	10	Table of analyses.....	65
Alabama.....	11	Western States.....	72
Maryland.....	11	California.....	72
Virginia.....	12	Nevada.....	73
North Carolina.....	12	Arizona.....	74
Georgia.....	13	Utah.....	75
Tennessee.....	13	Washington.....	75
Table of analyses.....	13	Wyoming.....	75
Great Lakes area.....	24	New Mexico and	
Michigan.....	24	Western Texas.....	76
Illinois.....	26	Oregon.....	76
Indiana.....	28	Montana.....	76
Table of analyses.....	29	Colorado.....	77
		Table of analyses.....	77
		Bibliography.....	83

^{1/} The Bureau of Mines will welcome reprinting of this paper provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Information Circular 7226."

^{2/} Nonmetal Economics Division, Bureau of Mines.

INTRODUCTION

Dolomite, heretofore regarded merely as a variety of commonplace limestone, has suddenly attained headline prominence, partly because of the increase in demand for dolomite refractories to line metallurgical furnaces now working at an unprecedented rate of activity, but chiefly because it has become an ore of the light-weight metal, magnesium, needed in vast quantities for the manufacture of war machines. A multitude of inquiries, chiefly from war agencies and prospective operators, for data not only on locations of dolomite deposits but on their size and quality, has made it necessary for the Bureau of Mines to assemble all information available on this important subject. From the Bureau's own records, published information, and correspondence, data on locations, extent, thickness, accessibility, workability, and chemical composition of high-grade dolomite deposits throughout the United States were accumulated for presentation herein. The report includes about 1,000 tabulations of analyses and a map showing locations of the deposits. The uses of dolomite are discussed in Bureau of Mines Information Circular 7192, "Occurrences and Uses of Dolomite in the United States," published in 1941.

The cordial cooperation of many State geological surveys and various individuals who have contributed information is gratefully acknowledged.

DEFINITION

The term dolomite is used both as a mineral name and as a rock name. When used to refer to the mineral, it has a very definite meaning, but when used as a rock name the definition is far less exact.

The mineral dolomite, according to Dana,^{3/} contains calcium carbonate and magnesium carbonate in equal molecular proportions. Expressed in weight-percentages, it consists of 45.65 percent $MgCO_3$ and 54.35 percent $CaCO_3$, or, stated in terms of oxides, 21.7 percent MgO , 30.4 percent CaO , and 47.9 percent CO_2 . It crystallizes in the rhombohedral division of the hexagonal system, and the crystal faces are generally bounded by curved rhombohedrons. It has a pearly luster, and the crystals may be transparent or translucent. The color varies and may be white, red, green, brown, gray, or black.

Dolomite, as a rock name, is applied to carbonate rocks containing substantial percentages of magnesium carbonate. No precise dividing line between dolomite and limestone or magnesium limestone has been agreed upon in the literature. The term has been applied to carbonate rocks containing as little as 15 or 20 percent $MgCO_3$ by some writers; others use 35 or 40 percent as the

^{3/} Dana, E. S., A Textbook of Mineralogy: 4th ed. (revised by W. E. Ford), New York, 1932, p. 516.

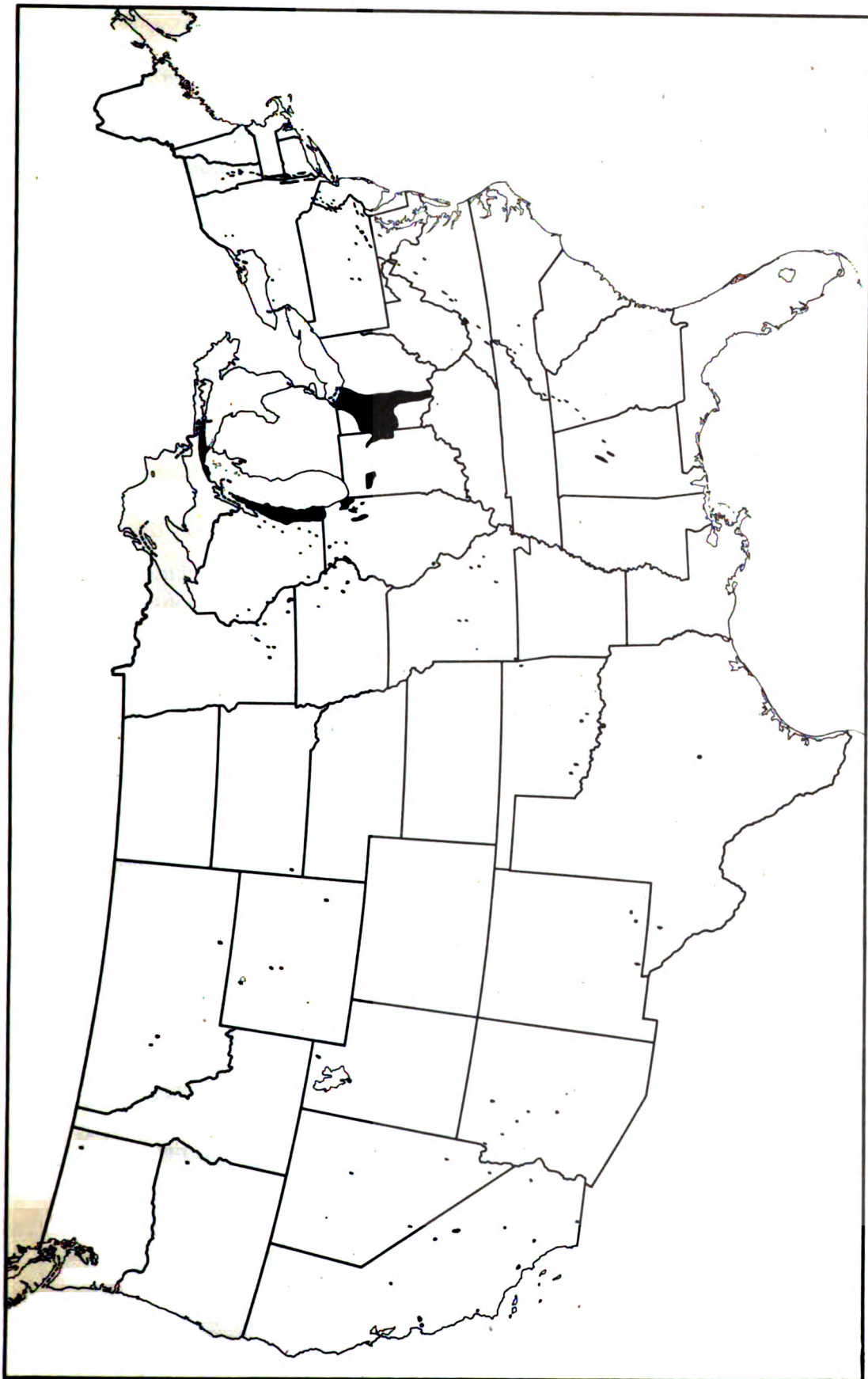


Figure 1.- High-purity dolomite deposits in the United States.

dividing line. For the purpose of this report dolomite is defined as a carbonate rock containing 40 to 45.65 percent magnesium carbonate and at least 90 percent total calcium and magnesium carbonates. "High-purity," "high-quality," and "high-grade" are used interchangeably to designate a dolomite containing at least 98 percent total carbonates and less than 2 percent of impurities, including iron oxides, alumina, and silica. Dolomite may be either fine- or coarse-grained and ranges in color from snow-white to gray, blue, or light buff.

Methods for distinguishing high-magnesium and high-calcium carbonate rocks by etching, staining, or reaction with hydrochloric acid are well-known, but these methods are inadequate for determining the purity of a dolomite. The only reliable test is a quantitative chemical analysis.

OCCURRENCE

New England Area

Dolomite is found in New England in a narrow north-south belt extending southward from west-central Vermont into western Massachusetts and western Connecticut. Southeastern New York, adjacent to the Massachusetts and Connecticut boundaries, is included in the same unit. This is known as the Taconic belt. Except for a small occurrence in Maine, the remainder of this area is barren of dolomite deposits.

Vermont

Although dolomites occur in Windham, Windsor, Rutland, and Addison Counties and have been quarried locally for agricultural uses and road metal, the State offers few possibilities for their use either as a refractory or for magnesia and magnesium production. Owing to the complexly folded and faulted structure of the marble belt and to the lateral and vertical gradations of dolomite into calcite, the occurrences are not continuous for any great distance and are generally small. Furthermore, calcite marble and dolomite are intimately interbedded in many places, and impurities such as silica and iron oxide are often present in excessive amounts. Although analysis No. 1 in table 1 indicates that high-grade dolomite occurs near Plymouth, this is not to be regarded as typical of Vermont dolomites, most of which contain less magnesium carbonate, and more silica and iron, and are classified more properly as high-magnesium limestones.

Massachusetts

High-grade dolomite occurs in western Berkshire County as an extension of the Vermont belt. As mapped by Dale,^{4/} the Stockbridge limestone, which constitutes this belt, is divided into a lower dolomitic part 500 to 800 feet thick and an upper calcitic part 200 to 400 feet thick. The dolomitic limestone extends north to south through Williamstown, North Adams, Adams, Cheshire, Lanesboro, Lennox, Stockbridge, West Stockbridge, Lee, Great Barrington, and Sheffield Townships. However, because of a heavy glacial cover over large parts of this area, interbedding of calcitic and dolomitic rock, and impurities similar to those encountered in Vermont the number and size of areas containing available high-grade dolomite are limited.

The variable formational dips, owing to a great deal of folding and faulting, must be considered in quarrying operations. Data on tonnages, lateral extent, and depth of the various deposits are unavailable, but it is well-established that several large deposits of more or less crystalline high-grade dolomite exist in the vicinity of Adams, Stockbridge, and Lee in western Massachusetts. Analyses of the dolomite of these areas are given in table 1. Analysis 3 indicates that high-grade dolomite occurs at South Barrington, but little is known about it.

Connecticut

In Connecticut, as in Vermont and Massachusetts, marble occurs in the lowlands and valleys and in many areas is covered more or less deeply by glacial debris. It enters the State from the north as a continuation of the Massachusetts marble area and extends southward as an interrupted belt to the town of Redding. Moore^{5/} divides the marble belt into four areas, but only one of them, the northern, is important as a source of high-grade dolomite. Apparently some dolomites occur near New Milford and near Danbury in the southern areas, but they are not consistently pure enough or high enough in magnesium carbonate over large areas to be of value insofar as can be ascertained. The bulk of the high-grade dolomite of Connecticut is in northwestern Litchfield County in Canaan, North Canaan, Salisbury, and Sharon Townships. In the Litchfield County area the structure is quite complicated, as in Massachusetts and Vermont. Dips of the beds average about 60° to the east but vary greatly, depending on the position of the outcrop or quarry in a fold. Variations in composition, both laterally and vertically, make prospecting and quarrying difficult, but nevertheless a

-
- ^{4/} Dale, T. N., The Lime Belt of Massachusetts and Parts of Eastern New York and Western Connecticut: Geol. Survey Bull. 744, 1923, p. 3.
- ^{5/} Moore, F. H., Marbles and Limestones of Connecticut: Connecticut Geol. Survey Bull. 56, 1935, p. 11.

number of quarries in this area produce high-grade dolomite and presumably have an abundant supply in reserve. The most important areas are near the towns of Canaan, North Canaan, East Canaan, Falls Village, Lakeville, Sharon Station, and Amesville and on the slopes of Rattlesnake Hill. Analyses at the end of this section in table 1 indicate the quality of the dolomite at the above-named localities.

Southeastern New York

The portions of Putnam, Dutchess, and Westchester Counties that are underlain by calcitic and dolomitic marbles and limestones are part of the Taconic belt both structurally and topographically. These dolomites are similar to those previously described in New England, though to the west they become less crystalline and less intensely folded.

Good-quality dolomite has been quarried at Dover Plains, South Dover, and Wingate Station in Dutchess County. The strata here comprise a continuous belt and dip steeply eastward. The material of highest purity is found in the eastern part of the county, whereas to the west it is lower grade. Tonnage estimates are not available. Table 1 lists the available analyses.

Westchester County has the best-known and perhaps the purest dolomite in southeastern New York. The stone has been quarried at many places in the county, notably at Ossining, Pleasantville, and Tuckahoe. According to Ries,⁶ the quarries at Tuckahoe are the most extensive and are all in the same stratum, which is 40 to 100 feet thick, dips steeply westward, and strikes northeast. The rock is coarsely granular and brilliant white. At Ossining are several quarries in a fine-grained gray dolomite dipping westward. Selective quarrying would probably be necessary to maintain a high magnesium carbonate content, because the stone in this area is of variable composition. The dolomite at Pleasantville is described as being remarkably uniform in character, white, and coarsely crystalline. It occurs in vertical strata and has a width of about 100 feet across the strike. Analyses in table 1 indicate the high-grade character of the dolomites in this county.

Good-quality dolomite is reported to occur at several places in Putnam County and is to be expected because of its position between Dutchess and Westchester Counties, but neither analyses nor tonnage estimates are available.

Maine

Dolomite deposits in Maine are of small extent and minor importance. They occur as pockets both within and stratigraphically below the high-calcium limestones of Knox County. One mile southwest of Rockland is a quarry (analysis 35, table 1) that has produced dolomite for pulp-making purposes; but the deposit is small, and the stone is generally high in talc and other impurities.

⁶/ Ries, H., The Limestone Quarries of Eastern New York, Western Vermont, Massachusetts, and Connecticut: Geol. Survey Ann. Rept., vol. 17, pt. III, 1896, p. 796.

The most important deposits of magnesian rock are included in a thin, lenslike belt 100 to 200 feet wide, 2 miles northwest of Warren. The rock is light gray to white, very fine-grained, and, according to the single analysis recorded, is virtually a pure dolomite (analysis 34, table 1). Because only small tonnages are available, it is improbable that the area will attain importance as a source of high-grade dolomite.

In the main Rockland-Thomaston limestone area local pockets of high-magnesium stone are reported.

TABLE 1. - Analyses of dolomites from the New England area

	1	2	3	4	5	6	7	8	9
MgCO ₃	44.7	43.88	-	-	-	-	-	-	-
MgO	-	21.42	20.17	20.99	20.75	20.46	20.33	21.35	21
R ₂ O ₃ ^{a/}	b/1.3	.24	.28	.66	.32	.31	.38	.17	-
SiO ₂	-	.19	1.78	1.58	.68	.78	3.63	1.01	.5
CaCO ₃	53.9	55.14	-	-	-	-	-	-	-
CaO	--	30.88	31.45	30.52	31.30	32.07	30.42	30.82	30
CO ₂	--	46.72	46.26	46.50	46.86	46.64	45.46	45.84	-

	10	11	12	13	14	15	16	17	18
MgCO ₃	49.21	44.94	45.12	45.1	44.00	-	-	43.92	-
MgO	-	-	-	-	-	20.0	20.20	-	21.48
R ₂ O ₃ ^{a/}	.19	.32	.25	.00	1.00	.5	.28	.55	.25
SiO ₂	.11	1.06	.08	.95	1.00	2.0	1.60	1.30	.08
CaCO ₃	50.49	54.42	54.40	54.8	54.00	-	-	54.67	-
CaO	-	-	-	-	-	30.0	31.70	-	30.46
CO ₂	-	-	-	-	-	-	46.17	-	47.58

a/ Fe₂O₃ and Al₂O₃. b/ Includes SiO₂.

TABLE 1. - Analyses of dolomites from the New England area (Cont'd.)

	19	20	21	22	23	24	25	26	27
MgCO ₃	-	42.56	42.93	-	45.04	43.11	44.71	43.57	43.62
MgO	21.03	-	-	19.95	-	-	-	-	-
R ₂ O ₃ ^{a/}	.20	-	1.05	.82	.18	-	.40	.21	b/.91
SiO ₂	.48	.42	2.71	.87	.10	.29	.24	1.33	-
CaCO ₃	-	56.57	53.43	-	54.12	54.80	53.92	53.90	54.69
CaO	31.31	-	-	31.40	-	-	-	-	-
CO ₂	46.98	-	-	-	-	-	-	-	-

	28	29	30	31	32	33	34	35
MgCO ₃	-	-	45.04	-	-	39.16	45.13	42.94
MgO	21.25	20.71	-	20.05	20.25	-	-	-
R ₂ O ₃ ^{a/}	.22	.40	.23	2.82	.62	b/.92	-	1.06
SiO ₂	.24	1.58	.10	5.94	.70	-	.95	2.87
CaCO ₃	-	-	54.62	-	-	57.00	53.52	53.13
CaO	30.16	30.63	-	29.05	30.63	-	-	-
CO ₂	47.30	46.66	-	-	46.66	-	-	-

a/ Fe₂O₃ and Al₂O₃. b/ Includes SiO₂.Locations of samples in table 1

1. Dolomite breccia from Plymouth, Vt.
2. Lee Berkshire County, Mass.
3. Southwest corner of South Barrington, Berkshire County, Mass.
4. Rattlesnake Hill, Stockbridge, Berkshire County, Mass.
5. Renfrew quarry, Adams, Berkshire County, Mass.
6. Upton's quarry, Adams, Berkshire County, Mass.
7. Dean's Mills, Adams, Berkshire County, Mass.
8. Webster, Worcester County, Mass.
9. West Stockbridge, Berkshire County, Mass.
10. Connecticut Lime Co. quarry, Canaan, Litchfield County, Conn.
- 11, 12. Quarry on south side of Rattlesnake Hill, Litchfield County, Conn.
13. Allyndale Lime Co., East Canaan, Litchfield County, Conn.
14. New England Lime Co., East Canaan, Litchfield County, Conn.
15. U. S. Gypsum Co. quarry, 2 miles north of Falls Village, Litchfield County, Conn.

Locations of samples in table 1 (Cont'd.)

16. Stearns Lime & Stone Co., Danbury, Conn. (one of 4 analyses).
17. Redding Marble Co. quarry, 1-1/2 miles northeast of West Redding P. O., Fairfield County, Conn.
- 18,19. Canfield Bros. quarry, East Canaan, Litchfield County, Conn.
20. Canaan Lime Co., Canaan, Litchfield County, Conn.
21. Westchester County, New York.
22. Ossining Lime & Stone Co., Ossining, Westchester County, N. Y.
- 23,24. Pleasantville, Westchester County, N. Y.
- 25-27. Masterton quarry, Tuckahoe, Westchester County, N. Y.
- 28,29. Tuckahoe, Westchester County, N. Y.
30. Pleasantville, Westchester County, N. Y.
31. Ossining, Westchester County, N. Y.
32. Wingdale, Dutchess County, N. Y.
33. Kelley Island Lime & Stone Co., Dover Plains, Dutchess County, N. Y.
34. Warren, Knox County, Maine.
35. 1 mile southwest of Rockland, Knox County, Maine.

Eastern and Southeastern States

All the known dolomite deposits in the Eastern and Southeastern States are found in a belt that follows the trend of the Appalachian Mountains. Most of them are in the lower Paleozoic rocks, although a few are in pre-Cambrian formations. According to available information, the largest and purest deposits are in Pennsylvania, West Virginia, and Alabama. Dolomite also occurs in New Jersey, Maryland, Virginia, Tennessee, North Carolina, and Georgia. In several of these States, particularly Maryland and Virginia, the presence of large bodies of high-purity stone may be established by further detailed field work. No high-grade dolomite is known in Florida, Mississippi, Kentucky, Delaware, or South Carolina.

All Paleozoic and pre-Cambrian rocks in the Appalachian belt have been folded more or less intensely and have been broken up considerably by faulting in many areas. These factors add to the problem of locating deposits suitable for quarrying. The dip of the strata, which is generally either southeast or northwest, ranges from horizontal to vertical. As the strike of the beds is prevalently northeast, deposits and outcrops are elongated in that direction. Metamorphism varies with the degree of deformation in any given area; hence, some of the dolomites are coarsely crystalline, whereas others are fine-grained and dense.

New Jersey

High-grade dolomite is reported to occur at many points in northern and northwestern New Jersey, but according to the New Jersey Geological Survey (personal communication, April 1942), commercial deposits do not occur in this State. Magnesian limestone is said to occur in abundance, both in the pre-Cambrian Franklin limestone and in the Cambro-Ordovician Kittatinny limestone. The Franklin limestone, which is found in a northeastward-trending belt in Warren

and Sussex Counties, is much dissected by faulting, and many of the remnants occur only in small areas. Furthermore, most of it is either high-calcium or high-silica rock, the magnesian rock being difficult to locate and too irregular in distribution for economical quarrying. The Kittatinny limestone is less metamorphosed than the Franklin formation and occupies a much wider area. It is found mainly to the northwest of the Franklin formation. Where unfaulted, it attains a thickness of 2,500 to 3,000 feet, and it is dolomitic in the upper part. Dips in these formations are very steep, approaching vertical in places. Analyses 1 to 24, table 2, indicate the quality of selected samples, most of which are too high in impurities to meet the standards for high-grade dolomite.

Pennsylvania

Dolomites found at many places in Pennsylvania, notably in the southeastern part, are of Cambrian and Ordovician age. As a general rule, high-purity stone does not have great areal or stratigraphic extent in any given county or district; nevertheless, moderately large reserves are available in a few of the areas to be discussed. The counties having high-purity dolomites are considered in alphabetical order.

Adams County dolomites are found in the Vintage and Ledger formations, which outcrop near and south of New Oxford. The combined thickness of these formations is about 3,000 feet, a large part of which is siliceous, impure dolomite and high-calcium limestone, which are intricately intermixed both by folding and by lateral gradation. Analyses 25 and 26, table 2, from a large quarry at Bittering in the Ledger dolomite, indicate the presence of high-grade rock but may not be representative of the entire quarry. Adams County does not appear to have extensive reserves of high-purity dolomite easily available for quarrying.

Cambrian and Ordovician dolomites are found in a limestone belt trending northeast through the center of Berks County. For the most part, these formations are highly folded and vary greatly in composition. Although most of them are dolomitic, they approach high purity in very few places. Gradations from limestone to dolomite over short distances and a rather high silica content are the main difficulties. (See analyses 29 to 36.)

Analyses 38 and 39 are reported to be from Blair County, but it is certain that they do not represent any large deposit. Dolomite found near New Hope, Bucks County (analyses 40 and 41, table 2), contains a high percentage of silica.

The limestones and dolomites of Chester County are found mainly in the rather narrow Chester Valley, which enters from Montgomery County a short distance southeast of Valley Forge and continues into Lancaster County in a direction slightly south of west. This band of limestone averages about 2 miles in width. Pre-Cambrian limestones are found in three isolated areas - Doe Run, Avondale, and Lendenburg - but apparently contain no high-purity dolomite. High-grade dolomites are found in the Cambro-Ordovician formations at Cedar Hollow, Mill Lane, and Planebrook (see analyses 42 to 52). The most extensive quarrying operations are at Cedar Hollow near Devault, where a quarry face is 3,000 feet long and 800 feet wide. The rock, a low-silica dolomite, dips 45° to 55° .

southward and strikes east. Two bands of high-purity stone are 150 and 500 feet wide on the surface and have been quarried to a depth of more than 60 feet. A dolomite said to be high-grade is quarried just west of Planebrook. Reserves of good-quality dolomite in Chester County are not known but may be large.

A dolomite deposit over 200 feet thick, covering at least 200 acres and containing millions of tons of available rock, has been reported near Spruce Creek, Huntingdon County. Analyses 53 to 55, table 2, from this area indicate that the silica content is too high to permit classifying this rock as a high-purity dolomite.

Analyses 58 to 73, from Lancaster County, show the presence of high-quality dolomite, although the beds tend to be spotty and variable in composition and contain a rather high percentage of silica. Dolomite of high purity is obtained in a quarry more than 200 feet deep near Billmeyer, but it is interbedded with more siliceous rock, making hand loading necessary. A small plant was once erected at Mount Joy for extracting magnesia from dolomite but closed when the rock was found to be unsatisfactory. Some high-purity dolomite has been obtained in several quarries north of Lancaster in the Ledger formation, but much of it is high in silica or is intermixed with low-magnesian beds.

Dolomitic limestones are abundant in Lehigh County, but no large, high-grade deposits are reported. Several quarries near Allentown, Alburtis, and Ormrod contain impure dolomite (see analyses 74 to 79).

Montgomery County is reported to have considerable reserves of low-silica dolomites, which are being used at present by steel plants and by plants manufacturing magnesia products. They probably represent the Ledger and Elbrook formations and in the aggregate are several hundred feet thick. Structural complexities and metamorphism make determination of thickness and estimation of tonnage reserves difficult. High-purity dolomites are or have been worked extensively at Plymouth Meeting, Bridgeport, Shainline, Fitzwatertown, and Port Kennedy (see analyses 80 to 101, table 2). The best grade is a dense, fine-grained, light-buff dolomite containing less than 1 percent silica in many places, although high-silica stone is also present. Care is necessary both in selecting quarry sites and in quarrying.

Analyses 102 to 112 indicate that most of the dolomite from Northampton County is rather high in impurities, especially in silica. Some high-quality dolomite occurs, but it is generally interbedded with low-magnesian and high-silica rock.

Good-quality dolomite is found at several places in York County, as shown by analyses 113 to 125. However, it is generally intermixed with impure rock. Although several small quarries near York, New Holland, and Thomasville have ledges of nearly pure dolomite 30 to 50 feet thick, a large output probably is not attainable.

West Virginia

Large commercial deposits of high-purity dolomites are confined to eastern Jefferson County. Analyses 147 to 178 (table 2) indicate the high quality of

of the material. It occurs in two more or less parallel belts of Waynesboro age. The eastern belt, 8 to 10 miles long, strikes northeast and passes about 1/2 mile east of Millville. Its thickness is variously estimated at 30 to 350 feet. The strata dip 50° or more and are overturned in places. Several large quarries operate in dolomite said to be of nearly theoretical purity. The most important quarrying areas are in the vicinity of Millville, on both sides of the Shenandoah River, and near Bakerton. A shorter and less important high-purity dolomite belt is about 1/2 mile west of Millville but cannot be traced far either north or south. No definite statement of reserves is available, but they probably are large, especially in the eastern belt.

Dolomite deposits are also reported from Berkeley, Taylor, Monroe, and Summers Counties, but available information indicates that they are either too small or too impure to have commercial importance.

Alabama

High-purity dolomite has been quarried extensively in the Birmingham Valley in Jefferson County, where the Upper Cambrian Ketona dolomite is the bedrock in a strip 30 miles long and 1/2 mile wide. The purity of this formation is indicated by analyses 233 to 236 (table 2). The strata dip 15° to 30°, and the deposits are estimated to be 500 feet thick. A substantial part of the formation probably approaches the theoretical composition of dolomite, and the beds have been quarried for a number of years to supply fluxing stone for the steel mills of the Birmingham district. Reserves are measured in billions of tons, according to the Alabama Geological Survey (personal communication, April 1942).

The Ketona dolomite also outcrops extensively in Shelby County north of Montevallo in the Shoal Creek area. Analyses of this material (226-232) indicate that it is a nearly pure dolomite. The strata dip 15° to 30°, and the vertical thickness may be as much as 500 feet, although the entire thickness probably is not high-grade rock. Millions of tons of good dolomite undoubtedly are available.

Near Talledega, Talledega County, a noncherty lens in an otherwise cherty dolomite of unknown age contains some high-grade dolomite (analyses 237 and 238). No information is available as to the thickness or extent of the deposit.

Analyses of the Chewacla formation near Opelika, Lee County, indicate the presence of high-quality dolomites in that area. The strata probably are pre-Cambrian and have been metamorphosed to coarse marble. No data on the continuity of the high-grade stone or estimates of tonnages are available.

The Jefferson and Shelby County dolomites are particularly well situated, being within a few miles of large industrial centers and close to the very extensive coal deposits of the Cahaba, Warrior, Coosa, and Blount Mountain coal basins.

Maryland

Dolomite occurs in Maryland in three areas - Baltimore, Frederick, and Washington Counties - although the only known deposits of high-grade, low-silica

stone are in Blatimore County (according to J. T. Singewald, Jr., in a personal communication dated March 1942). Here the dolomite is found in the Cockeysville marble, a highly metamorphosed formation of disputed age. Dips of beds change rapidly from place to place, and thickness of the beds is variable but is known to exceed 100 feet in some localities. The composition is quite variable both as to impurities and magnesia. Much of the rock appears to be a true dolomite, but much of it, also, is low in magnesia and high in silica. As the percentage of silica ranges from less than 1 to more than 5 in the same quarries, it is hard to find representative analyses. Analyses 128 to 139, 141, and 144 to 146 (table 2) indicate the range in composition. Because of its variability, an estimate of reserves is impossible. It is doubtful if the formation could be used extensively for high-purity dolomite, even with selective quarrying.

Frederick County has no known high-grade dolomites, although dolomitic limestones are common in the lower Ordovician formations. High-magnesia limestones occur in the Hagerstown Valley, Washington County, in the lower Cambrian Tomstown formation. Certain beds within this formation approach pure dolomite in composition and contain less than 1 percent silica in places (see analyses 140, 142, and 143), but little is known concerning possible workable thicknesses of high-grade stone. However, as nearly pure dolomite occurs in the vicinity of Millville and Bakerton, W. Va., in rocks of the same geologic age, exploration may uncover sizable deposits of high-quality material in Washington County.

Virginia

No detailed information is available regarding high-purity dolomites in Virginia. Analyses 179 to 185 (table 2) indicate that in several localities, particularly at Marion (Smyth County), Rock Point and Indian Rock (Botetourt County), and Berryville (Clark County), high-quality stone is present. Dolomite and dolomitic limestones occur in great thicknesses in the highly folded Cambrian and Ordovician formations of the western part of the State (according to a communication from the Virginia Geological Survey dated May 1942). However, it is not known what parts of these beds are of high purity or how much high-grade material is available in any given area. Further sampling and exploration of Virginia dolomites is now in progress and may reveal acceptable deposits of considerable magnitude.

North Carolina

Dolomites are reported to occur at several localities in the pre-Cambrian and lower Paleozoic rocks of Mitchell, Yancey, Cherokee, Swain, McDowell, and Catawba Counties. Analyses 186 to 204 (table 2) indicate their quality. Those from Mitchell and Swain Counties and some from McDowell County indicate the presence of high-purity dolomite, but data on the extent of most of the deposits are unavailable. A deposit containing less than 1 percent total impurities and more than 43 percent $MgCO_3$ is reported from Burnsville, Yancey County. At Toecane, Mitchell County, a 600,000-ton deposit of exceptionally pure crystalline dolomite is said to be readily accessible by rail and truck (see analysis 186).

Georgia

Dolomite occurs in northern and northwestern Georgia in Pickens, Fannin, Gilmer, Polk, Floyd, Catoosa, Habersham, and Bartow Counties, but according to available analyses high-purity stone is confined to the first three (see analyses 214 to 225, table 2). Analysis 225 from the Harrison quarry, 2 miles east of Jasper, Pickens County, represents a low-silica dolomite, though somewhat low in magnesia. The extent and availability of rock of this quality are not known. Good dolomite has been reported at the Holt property in Gilmer County (analysis 219), but no further information is available. The Dickey property, east of Mineral Bluff, Fannin County, is represented by a single analysis which indicates the presence of an unknown quantity of very pure dolomite. Further field work in northern Georgia may disclose the presence of other high-grade deposits.

Tennessee

Dolomites and dolomitic limestones are abundant in the early Paleozoic formations in the eastern third of the State, but data concerning the purity of sizable deposits are lacking. Analyses 205 to 213, all from Johnson County in the extreme northeastern corner of the State, indicate that some high-quality stone may be found there, although most of it appears to be high in P_2O_5 . High-purity dolomites are reported in Knox and Hamilton Counties, where high-silica rock predominates. Until the results of field work now in progress by the Tennessee Geological Survey become available, no definite statements can be made.

TABLE 2. - Analyses of dolomites from Eastern and Southeastern States

	1	2	3	4	5	6	7	8	9
$MgCO_3$	-	-	-	43.25	-	-	-	-	-
MgO	20.52	20.63	21.71	-	19.29	20.3	20.3	20.3	20.2
$R_2O_3^a$	1.1	1.06	1.4	1.89	.8	2.2	1.8	.6	.9
SiO_2	5.9	4.92	1.95	2.28	4.9	1.1	2.7	1.8	4.8
$CaCO_3$	-	-	-	52.45	-	-	-	-	-
CaO	28.61	29.62	30.13	-	30.41	29.5	29.6	29.4	29.0
CO_2	44.88	-	-	-	42.6	45.6	45.5	45.7	44.9

a/ Fe_2O_3 and Al_2O_3 .

TABLE 2. - Analyses of dolomites from Eastern and Southeastern States (Cont'd.)

	10	11	12	13	14	15	16	17	18
MgCO ₃	-	-	-	-	-	-	40.52	43.92	44.51
MgO	19.07	20.07	19.1	19.4	19.5	19.3	-	-	-
R ₂ O ₃ ^{a/}	1.9	3.5	.8	2.7	2.2	1.2	1.80	1.55	.85
SiO ₂	8.13	.5	3.6	2.3	4.0	6.4	5.78	.66	.09
CaCO ₃	-	-	-	-	-	-	51.12	54.31	55.28
CaO	28.22	29.68	30.4	30.0	29.3	29.1	-	-	-
CO ₂	-	45.51	44.9	44.9	44.6	43.4	-	-	-

	19	20	21	22	23	24	25	26	27
MgCO ₃	44.24	-	-	-	-	-	46.80	41.50	42.58
MgO	-	19.2	19.3	20.0	19.9	19.2	-	-	-
R ₂ O ₃ ^{a/}	1.15	1.4	1.3	1.4	1.0	1.1	-	-	-
SiO ₂	.07	2.9	4.3	2.3	3.4	3.6	.6	2.0	1.8
CaCO ₃	55.28	-	-	-	-	-	51.70	55.00	54.68
CaO	-	29.6	29.8	29.6	29.8	30.8	-	-	-
CO ₂	-	46.2	44.7	45.4	45.4	45.4	-	-	-

	28	29	30	31	32	33	34	35	36
MgCO ₃	40.00	43.38	42.78	40.04	40.52	41.60	41.85	40.36	42.61
SiO ₂	5.41	1.2	3.89	3.41	7.17	3.40	3.60	6.42	2.47
CaCO ₃	52.58	54.71	52.86	53.84	51.84	54.64	53.39	52.36	54.27

^{a/} Fe₂O₃ and Al₂O₃.

TABLE 2. - Analyses of dolomites from Eastern and Southeastern States (Cont'd.)

	37	38	39	40	41	42	43	44	45
MgCO ₃	-	41.32	44.18	42.11	40.32	42.69	41.90	43.03	43.58
MgO	19.48	-	-	-	-	-	-	-	-
R ₂ O ₃ ^{a/}	.89	1.19	.23	1.75	5.53	-	-	-	-
SiO ₂	4.48	2.91	1.33	3.60	-	.85	1.51	2.12	.96
CaCO ₃	-	53.87	54.57	52.50	53.49	54.01	54.13	55.18	54.26
CaO	30.18	-	-	-	-	-	-	-	-

	46	47	48	49	50	51	52	53	54
MgCO ₃	42.96	44.26	44.11	43.31	45.2	41	-	42.09	42.34
MgO	-	-	-	-	-	-	20.57	-	-
R ₂ O ₃ ^{a/}	-	-	-	-	.37	-	.43	1.63	1.27
SiO ₂	1.50	1.53	2.49	1.9	-	-	.85	4.29	4.13
CaCO ₃	55.01	52.13	54.09	54.07	54.15	52	-	51.11	51.46
CaO	-	-	-	-	-	-	30.87	-	-
CO ₂	-	-	-	-	-	-	46.90	-	-

	55	56	57	58	59	60	61	62	63
MgCO ₃	42.00	42.69	43.44	42.85	42.26	43.71	42.84	41.08	43.12
R ₂ O ₃ ^{a/}	.75	.94	.22	-	-	-	-	-	.60
SiO ₂	2.00	2.16	4.09	1.4	.28	.49	1.03	3.52	2.50
CaCO ₃	55.25	54.39	51.74	55.01	55.42	55.35	54.84	53.54	53.43

	64	65	66	67	68	69	70	71	72
MgCO ₃	44.03	43.22	44.05	42.94	40-45	41-44	41.79	44.31	45.00
R ₂ O ₃ ^{a/}	-	-	-	-	-	-	.98	1.14	-
SiO ₂	.57	.49	.33	1.49	.6-2.2	-	1.09	.54	2.00
CaCO ₃	55.01	54.96	55.03	54.50	53-56	50-55	55.88	54.16	52.00

^{a/} Fe₂O₃ and Al₂O₃.

TABLE 2. - Analyses of dolomites from Eastern and Southeastern States (Cont'd.)

	73	74	75	76	77	78	79	80	81
MgCO ₃	42.75	45.35	41.29	42.60	41.07	41.30	40.41	43.10	44.64
R ₂ O ₃ ^{a/}	-	-	-	-	-	-	-	-	.21
SiO ₂	3.24	1.20	3.80	3.30	5.65	2.32	9.24	.90	.48
CaCO ₃	52.00	51.73	52.08	51.60	51.92	53.20	48.63	55.62	55.15

	82	83	84	85	86	87	88	89	90
MgCO ₃	44.00	43.22	41.95	44.12	40.13	39.10	41.62	41.22	40.96
R ₂ O ₃ ^{a/}	1.25	-	-	-	-	-	.80	-	-
SiO ₂	1.25	.65	.75	1.10	2.11	1.65	.80	1.10	1.48
CaCO ₃	53.50	55.23	56.32	55.05	55.78	57.10	56.46	55.80	55.72

	91	92	93	94	95	96	97	98	99
MgCO ₃	42.07	41.03	44.00	42.72	43.19	43.49	43.75	41.97	45.76
R ₂ O ₃ ^{a/}	-	-	-	-	-	.45	.40	.72	.45
SiO ₂	1.72	1.12	-	2.14	.41	1.24	.70	1.58	.2
CaCO ₃	55.56	55.19	55.00	53.89	55.00	54.91	55.15	55.7	53.49

	100	101	102	103	104	105	106	107	108
MgCO ₃	45.51	-	41.0	43.28	40.43	42.92	41.74	41.04	40.49
MgO	-	20.60	-	-	-	-	-	-	-
R ₂ O ₃ ^{a/}	.2	.99	2.0	.58	-	1.10	.73	1.89	-
SiO ₂	.25	1.00	4.0	1.9	1.7-7.7	1.68	4.94	5.67	6.88
CaCO ₃	54.04	-	53.00	52.16	-	53.77	52.37	50.49	47.21
CaO	-	30.30	-	-	-	-	-	-	-
CO ₂	-	46.50	-	-	-	-	-	-	-

a/ Fe₂O₃ and Al₂O₃.

TABLE 2. - Analyses of dolomites from Eastern and Southeastern States (Cont'd.)

	109	110	111	112	113	114	115	116	117
MgCO ₃	42.26	43.17	32-43	41.43	41.84	40.09	40.0	42.3	42.65
R ₂ O ₃ ^{a/}	3.00	-	-	2.20	-	-	-	-	-
SiO ₂	6.94	4.76	2-7	4.77	2.0	4.36	1.1	.3	1.0
CaCO ₃	47.66	51.37	51-59	53.43	54.25	53.09	56.05	56.90	55.35

	118	119	120	121	122	123	124	125	126
MgCO ₃	42.38	42.56	42.68	42.90	41.60	41.10	40.07	44.51	43.02
R ₂ O ₃	-	-	-	-	-	-	2.33	.66	.72
SiO ₂	.71	.89	1.11	.81	1.2	3.70	1.28	.56	.8
CaCO ₃	55.91	55.48	55.49	55.23	55.51	54.44	56.44	54.26	55.46

	127	128	129	130	131	132	133	134	135
MgCO ₃	43.32	-	-	-	40.31	40.10	40.10	40.50	40.45
MgO	-	20.87	20.30	17.62	-	-	-	-	-
R ₂ O ₃ ^{a/}	.72	1.22	.40	.70	-	-	-	-	-
SiO ₂	.91	.44	5.57	3.02	3.20	5.00	4.20	3.35	2.71
CaCO ₃	54.71	-	-	-	50.24	53.02	53.13	54.24	55.12
CaO	-	30.73	29.08	33.19	-	-	-	-	-
CO ₂	-	47.07	44.26	45.47	-	-	-	-	-

	136	137	138	139	140	141	142	143	144
MgCO ₃	41.60	40.35	40.10	41.25	-	43	-	-	-
MgO	-	-	-	-	19.51	-	20.37	21.12	21.28
R ₂ O ₃ ^{a/}	-	-	-	-	1.28	1	.27	-	.39
SiO ₂	4.00	4.55	3.64	2.30	1.77	1	3	.7	.17
CaCO ₃	50.70	53.13	53.02	55.30	-	54	-	-	-
CaO	-	-	-	-	31.80	-	30.21	30.76	30.88
CO ₂	-	-	-	-	45.69	-	46.06	47.4	47.59

^{a/} Fe₂O₃ and Al₂O₃.

TABLE 2. - Analyses of dolomites from Eastern and Southeastern States (Cont'd.)

	145	146	147	148	149	150	151	152	153
MgCO ₃	-	-	41.71	40.42	43.18	45.00	45.00	46.00	43.89
MgO	20.80	19.05	-	-	-	-	-	-	-
R ₂ O ₃ ^{a/}	1.55	3.18	1.25	1.35	.89	.41	.57	.47	.89
SiO ₂	2.33	6.73	3.90	5.63	.05	.40	.30	.30	1.05
CaCO ₃	-	-	52.64	52.32	55.72	55.00	55.00	54.00	53.56
CaO	29.30	29.64	-	-	-	-	-	-	-
CO ₂	46.00	41.90	-	-	-	-	-	-	-

	154	155	156	157	158	159	160	161	162
MgCO ₃	45.03	44.26	44.69	43.90	44.48	45.16	44.60	45.35	45.75
R ₂ O ₃ ^{a/}	.33	.61	.45	.40	.94	.60	1.14	.90	.16
SiO ₂	.48	.43	.38	.53	.82	.32	.60	.40	.16
CaCO ₃	54.08	54.43	54.29	54.11	54.32	54.33	53.92	53.72	54.40

	163	164	165	166	167	168	169	170	171
MgCO ₃	44.57	44.25	41.88	40.3	43.18	45.0	45	46	42.69
R ₂ O ₃ ^{a/}	.35	.79	2.66	.9	.89	.41	.57	.47	.59
SiO ₂	.18	.68	1.64	1.6	.05	.4	.3	.55	2.44
CaCO ₃	54.90	54.28	53.82	57.2	54.72	55.0	55	54	52.62

	172	173	174	175	176	177	178	179	180
MgCO ₃	43.68	41.86	41.73	43.4	-	45.42	-	45.89	43.0
MgO	-	-	-	-	20.60	-	21.50	21.95	-
R ₂ O ₃ ^{a/}	.57	.64	6.92	.48	1.10	.62	.67	.54	1.04
SiO ₂	.95	3.68	10.92	1.68	1.50	.60	.60	1.34	1.97
CaCO ₃	54.75	52.35	30.62	53.88	-	54.22	-	54.13	54.20
CaO	-	-	-	-	30.50	-	30.60	30.32	-
CO ₂	-	-	-	-	46.50	-	46.70	46.53	42.14

^{a/} Fe₂O₃ and Al₂O₃.

TABLE 2. - Analyses of dolomites from Eastern and Southeastern States (Cont'd.)

	181	182	183	184	185	186	187	188	189
MgCO ₃	42.14	43	42.72	45.8	--	43.99	-	-	-
MgO	-	-	-	-	21.42	-	19.27	19.58	20.70
R ₂ O ₃ ^{a/}	.86	-	1.28	.8	.22	.30	-	1.90	-
SiO ₂	.78	-	3.28	5.4	.26	.10	5.20	1.58	2.10
CaCO ₃	54.55	54	51.72	47.48	-	55.68	-	-	-
CaO	-	-	-	-	29.95	-	28.62	32.40	30.14
CO ₂	46.46	-	-	-	45.00	-	43.79	47.00	47.45

	190	191	192	193	194	195	196	197	198
MgO	20.21	21.43	21.08	20.59	20.79	21.20	19.56	19.57	19.29
R ₂ O ₃ ^{a/}	.99	.11	.18	.88	.88	.60	1.30	.84	1.32
SiO ₂	.01	.12	.38	1.01	1.92	1.68	5.96	1.87	1.81
CaO	31.00	30.67	31.29	30.93	29.69	29.97	29.13	30.68	30.59
CO ₂	46.33	47.55	47.15	46.60	45.86	46.52	44.07	45.38	46.98

	199	200	201	202	203	204	205	206	207
MgCO ₃	-	-	-	-	-	-	42.87	43.5	44.6
MgO	21.22	19.58	19.85	20.01	20.09	19.07	-	-	-
R ₂ O ₃ ^{a/}	.70	.70	1.19	.73	1.54	3.17	-	-	-
SiO ₂	.60	1.40	2.74	1.85	2.60	1.28	1.12	1.78	.48
CaCO ₃	-	-	-	-	-	-	55.45	52.6	53.7
CaO	30.29	29.23	29.52	29.68	34.27	33.18	-	-	-
CO ₂	47.10	44.47	44.77	40.07	-	-	-	-	-
Ca/Fe ₂ O ₃	-	-	-	-	-	-	1.15	2.61	-

^{a/} Fe₂O₃ and Al₂O₃.

TABLE 2. - Analyses of dolomites from Eastern and Southeastern States (Cont'd.)

	208	209	210	211	212	213	214	215	216
MgCO ₃	44.57	40.03	42.7	41.8	41.32	43.81	41.15	39.44	-
MgO	-	-	-	-	-	-	-	-	18.88
R ₂ O ₃ ^{a/}	-	-	-	-	-	-	1.5	1.7	1.80
SiO ₂	1.03	6.60	2.05	2.72	2.50	2.04	3.5	6.25	5.74
CaCO ₃	53.61	50.50	54.2	55.3	55.60	53.74	53.44	52.64	-
CaO	-	-	-	-	-	-	-	-	28.88
CO ₂	-	-	-	-	-	-	-	-	44.64
Ca ₃ (PO ₄) ₂	.64	.76	1.98	-	.89	.32	-	-	-

	217	218	219	220	221	222	223	224	225
MgO	19.64	21.30	21.60	18.98	19.46	18.64	20.98	20.72	19.37
R ₂ O ₃ ^{a/}	.74	.24	.78	2.08	2.31	2.59	1.59	2.05	.35
SiO ₂	1.73	.10	1.01	4.12	4.22	3.25	1.85	.16	.73
CaO	31.89	31.53	31.61	28.72	29.24	30.26	23.56	31.54	32.73
CO ₂	46.00	47.26	46.49	45.85	44.53	45.23	47.01	45.37	46.58

	226	227	228	229	230	231	232	233	234
MgCO ₃	44.02	43.76	43.51	43.85	43.77	44.01	43.82	42.2	42.47
R ₂ O ₃ ^{a/}	-	-	-	-	-	-	-	.7	.96
SiO ₂	.61	.68	.96	.49	.64	.44	.64	1.1	1.31
CaCO ₃	54.73	54.04	53.70	54.02	54.57	54.71	54.30	55.4	55.80

	235	236	237	238	239	240	241	242
MgCO ₃	43.00	43.00	44.85	41.79	41.84	44.04	42.94	42.95
R ₂ O ₃ ^{a/}	.63	1.00	.44	2.63	1.04	.33	.25	.40
SiO ₂	.70	1.25	.33	2.13	1.64	.09	1.39	.17
CaCO ₃	56.41	54.00	55.07	52.70	56.07	55.48	55.07	55.42

a/ Fe₂O₃ and Al₂O₃.

Locations of samples in table 2

- 1-3. Newton, Hunterdon County, N. J.
4. Vernoy, Hunterdon County, N. J.
5. Montville, Morris County, N. J.
6. Macopin, Passaic County, N. J.
7. West Milford, Passaic County, N. J.
- 8-10. Newton, Sussex County, N. J.
11. Ogdensburg, Sussex County, N. J.
12. Vernon Township, Sussex County, N. J.
- 13-15. Wantage Township, Sussex County, N. J.
- 16-19. Wall rock of ore body, Franklin Furnace, Sussex County, N. J.
20. Belvidere, Warren County, N. J.
21. Bushkill, Warren County, N. J.
22. Columbia, Warren County, N. J.
23. New Hampton, Warren County, N. J.
24. Phillipsburg, Warren County, N. J.
- 25-26. Bittering, Adams County, Pa.
- 27-28. 2-1/2 miles northwest of Hanover, Adams County, Pa.
29. 1/2 mile north of Clayton, Berks County, Pa.
30. 2 miles east of Seisholtzville, Berks County, Pa.
31. 1/4 mile north of Dale, Berks County, Pa.
32. 1/2 mile southwest of Bechtelville, Berks County, Pa.
33. 1/4 mile west of Greshville, Berks County, Pa.
- 34-35. 1/2 mile north of Earlville, Berks County, Pa.
36. 1/2 mile north of Rabbit, Berks County, Pa.
37. Everett, Bedford County, Pa.
38. Birmingham, Blair County, Pa.
39. Rodman Furnace, Blair County, Pa.
- 40-41. 2-1/2 miles northwest of New Hope, Bucks County, Pa.
- 42-44. Cedar Hollow, Chester County, Pa.
45. Mill Lane, Chester County, Pa.
46. 1 mile east of Mill Lane, Chester County, Pa.
47. 1-1/2 miles northeast of Mill Lane, Chester County, Pa.
48. Planebrook, Chester County, Pa.
49. 1-1/2 miles southwest of London Grove, Chester County, Pa.
50. Near Downingtown, Chester County, Pa.
51. Paoli, Chester County, Pa.
52. Devault, Chester County, Pa.
- 53-55. Spruce Creek, Huntingdon County, Pa.
- 56-57. Near Mont Alto, Franklin County, Pa.
- 58-60. 1 mile north of Lancaster, Lancaster County, Pa.
- 61-62. Centerville, Lancaster County, Pa.
- 63-64. Chickies, Lancaster County, Pa.
65. 3/4 mile south of Newtown, Lancaster County, Pa.
66. 1/2 mile southwest of Newtown, Lancaster County, Pa.
67. Landis Valley, Lancaster County, Pa.
68. Stickler Run, Lancaster County, Pa.
69. Chickies, Lancaster County, Pa.
70. East side of Donegal Creek, Lancaster County, Pa.

Locations of samples in table 2 (Cont'd.)

- 71-72. Bainbridge, Lancaster County, Pa.
- 73. Elverson, Lancaster County, Pa.
- 74. Allentown, Lehigh County, Pa.
- 75-76. East Allentown, Lehigh County, Pa.
- 77. Alburtis, Lehigh County, Pa.
- 78. Catasauqua, Lehigh County, Pa.
- 79. 1-1/2 miles northeast of Trexlertown, Lehigh County, Pa.
- 80. Williams, Montgomery County, Pa.
- 81-84. Bridgeport, Montgomery County, Pa.
- 85. Fitzwatertown, Montgomery County, Pa.
- 86-87. Mogee, Montgomery County, Pa.
- 88-92. Plymouth Meeting, Montgomery County, Pa.
- 93-94. Port Kennedy, Montgomery County, Pa.
- 95. Shainline, Montgomery County, Pa.
- 96-97. Port Kennedy, Montgomery County, Pa.
- 98. Bridgeport, Montgomery County, Pa.
- 99-100. Norristown, Montgomery County, Pa.
- 101. Ambler, Montgomery County, Pa.
- 102-103. Bethlehem, Northampton County, Pa.
- 104. 1/2 mile north of Brodhead, Northampton County, Pa.
- 105. Easton, Northampton County, Pa.
- 106-107. Freemansburg, Northampton County, Pa.
- 108-109. Hellertown, Northampton County, Pa.
- 110-111. Portland, Northampton County, Pa.
- 112. Redington, Northampton County, Pa.
- 113-114. Menges Mill, York County, Pa.
- 115. New Holland, York County, Pa.
- 116. Thomasville, York County, Pa.
- 117-121. 2 miles west of York, York County, Pa.
- 122. 1-1/2 miles southwest of York, York County, Pa.
- 123. 1 mile west of York, York County, Pa.
- 124. Saginaw, York County, Pa.
- 125. Wrightsville, York County, Pa.
- 126. Plymouth Meeting, Montgomery County, Pa.
- 127. Lancaster County, Pa.
- 128-129. Beaver Dam quarry, Baltimore County, Md.
- 130. Texas, Baltimore County, Md.
- 131. Jessup quarry, Cockeysville, Baltimore County, Md.
- 132. Merryman quarry, Cockeysville, Baltimore County, Md.
- 133-134. White quarry, Cockeysville, Baltimore County, Md.
- 135. Creek outcrop, White quarry, Cockeysville, Baltimore County, Md.
- 136. Gilmore property, Summerfield, Baltimore County, Md.
- 137-138. Old Parks property, Texas, Baltimore County, Md.
- 139. Beaver Dam quarry, Cockeysville, Baltimore County, Md.
- 140. Cavetown, Washington County, Md.
- 141. Lock Raven, Baltimore County, Md.
- 142-143. Hagerstown Valley, Washington County, Md.
- 144. Beaver Dam quarry, Cockeysville, Baltimore County, Md.

Locations of samples in table 2 (Cont'd.)

- 145-146. Baltimore County, Maryland.
- 147-148. South of Martinsburg, Berkeley County, W. Va.
- 149-152. Millville, Jefferson County, W. Va.
- 153-157. 1/2 mile east of Millville, Jefferson County, W. Va.
- 158-162. 1/2 mile west of Millville, Jefferson County, W. Va.
- 163-166. 2-1/2 miles north of Millville, Jefferson County, W. Va.
- 167. South of Millville, near Wetzel farm, Jefferson County, W. Va.
- 168-169. Millville, Jefferson County, W. Va.
- 170-171. Across Shendandoah River from Millville, Jefferson County, W. Va.
- 172-173. East of Bakerton, Jefferson County, W. Va.
- 174. Boonesville, Taylor County, W. Va.
- 175. 2 miles southwest of Harpers Ferry, Jefferson County, W. Va.
- 176-178. Millville, Jefferson County, W. Va.
- 179. 3 miles east of Berryville, Clarke County, Va.
- 180-181. 5 miles south of Marion, Smyth County, Va.
- 182. Rocky Point, near Buchanan, Botetourt County, Va.
- 183. 5 miles from Gordonsville, Orange County, Va.
- 184. Shenandoah, Page County, Va.
- 185. Indian Rock, Botetourt County, Va.
- 186. Toecane, near Bandana, Mitchell County, N. C.
- 187-189. Cherokee County, N. C.
- 190. Swain County, N. C.
- 191-192. Mitchell County, N. C.
- 193-202. McDowell County, N. C.
- 203-204. Catawba County, N. C.
- 205. 3-1/2 miles from Mountain City, Johnson County, Tenn.
- 206. 4 miles north of Mountain City, Johnson County, Tenn.
- 207-208. 1/2 mile southeast of Silver Lake, Johnson County, Tenn.
- 209-210. West side of Forge Creek, 1/2 mile from Roane Creek, Johnson County, Tenn.
- 211. N. Garland quarry, near Mountain City, Johnson County, Tenn.
- 212. T. K. Garland quarry, Shady, Johnson County, Tenn.
- 213. 1/2 mile northwest of No. 212.
- 214. Cave Spring, Bartow County, Ga.
- 215. Dykes Creek, Pickens County, Ga.
- 216. Billy Walker quarry, Habersham County, Ga.
- 217-218. 1 mile east of Mineral Bluff, Fannin County, Ga.
- 219. Holt property, Gilmer County, Ga.
- 220. Young's Station, Polk County, Ga.
- 221. Vans Valley, Floyd County, Ga.
- 222. Average of 125 feet, 1/2 mile east of Graysville, Catoosa County, Ga.
- 223. Average of 50 feet, 1/2 mile east of Graysville, Catoosa County, Ga.
- 224. 2 miles southwest of Cartersville, Bartow County, Ga.
- 225. J. P. Harrison quarry, 2 miles east of Jasper, Pickens County, Ga.
- 226-232. Freoman Farms, 5 miles north of Montevallo, Shelby County, Ala.
- 233. Dolonah quarry, 2 miles west of Bessemer, Jefferson County, Ala.
- 234. Ketona quarry, Jefferson County, Ala.
- 235. North Birmingham quarry, North Birmingham, Jefferson County, Ala.
- 236. Near Birmingham quarry, Jefferson County, Ala.
- 237-238. Copper Ridge dolomite, Isbell Springs near Talledega, Talledega County, Ala.
- 239-242. Chewacla dolomite, Lee County, Ala.

Great Lakes Area

High-purity dolomites in the five Great Lakes States north of the Ohio River and east of the Mississippi are in a circular belt bordering the Great Lakes. To the east this belt passes through the Province of Ontario, Canada, to Lake Huron. Michigan, Wisconsin, Illinois, Indiana, and Ohio possess the purest, most accessible, and most continuous area of dolomite in the United States. Deposits of high-quality material are virtually unlimited, generally offer only minor and local quarrying problems, and are readily accessible to the cheapest transportation known - water haulage. This latter advantage applies mainly to the fine dolomites on the Upper Peninsula of Michigan and the eastern shore of Wisconsin. Most of the Ohio, Indiana, and Illinois dolomites require truck or rail transportation to their destinations or a haul partly by boat and partly by rail or truck.

The strata containing the dolomites in this area are Silurian in age and belong to the Niagara and Monroe formations. They are as much as several hundred feet thick. The gentle dips of the whole area are in general toward the center of the lower peninsula of Michigan. The outcrop of these Silurian rocks represents the edge of the so-called Michigan Basin, a very large but only slightly deformed geological feature. In Indiana and Ohio the prevailing dips are interrupted somewhat by several large, low arches or geanticlines, the most important of which is the Cincinnati arch. Complications in the geology of this large area that could conceivably interfere with quarrying operations are virtually absent. The presence of a rather heavy glacial cover over parts of the region is the only problem of importance in locating a quarry site, aside from the usual economic considerations and the purity of the stone.

Michigan^{7/}

Large tonnages of high-purity dolomites are available from the southern edge of the Upper Peninsula of Michigan in Schoolcraft, Mackinac, and Chippewa Counties. An arcuate band, concave southward, of upper Niagaran Guelph and Engadine dolomite 5 to 20 miles wide extends from Seoul Choix Point, Schoolcraft County, to the easternmost point of Drummond Island, Chippewa County. This band ranges in thickness from less than 20 to more than 50 feet and is uniformly high grade throughout its extent, both areally and stratigraphically. The northern edge of its outcrop is expressed in a low cuesta sloping steeply north and very gently southward. The southward slope is virtually an expression of the dip of the formation, which is 40 to 60 feet a mile. This dip is quite uniform and is due to the Michigan Basin structure. The Michigan Basin is a very large, slightly warped area centering in the middle of the Lower Peninsula and affecting the surrounding areas of northwestern Ohio, northern Indiana, northeastern Illinois, and eastern Wisconsin. It may be thought of as similar to a pile of nested dishes, fastened together and planed off by erosional agencies. Thus, in moving out from the center of the basin successively older beds are crossed. Because of this type of structure, the outcrop of the Silurian formations is roughly circular. The band touches Michigan only on the Upper Peninsula and in the southeastern corner of the State in Monroe and Wayne Counties. Because the dolomite is not as pure and the drift cover is thicker,

^{7/} From a personal communication of March 1942, from the Michigan Geological Survey.

the latter locality is of far less actual and potential importance than the northern area.

The area of high-purity dolomites on the Upper Peninsula is largely covered by glacial debris, but in many places this drift cover is negligible or absent. The Engadine dolomite, the upper member of the Niagara, is the formation of highest quality and uniformity. It is overlain to the south by the Bass Island series, which consists chiefly of brecciated, gray argillaceous dolomite, and underlain by the Manistique series, a thick succession of dolomite and high-magnesia limestones. The Engadine dolomite is massive, hard, and crystalline and has a distinctly bluish color. The stone shows little or no bedding and only poorly developed, irregular joint systems. In many places its outcrops are strewn with large dolomite boulders, as at Engadine, Ozark, Garnet, and Hessel.

Analyses 1 to 67 (table 3), from the Engadine dolomite in Chippewa, Mackinac, and Schoolcraft Counties, indicate the uniformly high quality of the stone. The $MgCO_3$ content is rarely less than 43 percent, and the impurities generally are not greater than 1.5 percent. Many of the localities represented by these analyses are readily accessible to gravel or dirt roads, railroads, or present and potential harbor developments.

Analysis 60 (table 3) is representative of a deposit in extreme southeastern Schoolcraft County, which has estimated reserves of 50,000,000 tons and which is 1 mile west of a harbor development of the Inland Line & Stone Co. The reserves of an area north of Buel Lake, Mackinac County, R. 11 W., T. 42 N., from which analyses 50 to 52 were taken, are estimated at 180 million tons. A possible harbor development is 4 miles due south of the area by improved dirt and gravel road. Analyses 53 and 54 (table 3) represent a 135,000,000-ton deposit 2 miles west and south of Engadine on the Minneapolis, St. Paul, & Sault Ste. Marie Railroad.

A large deposit in the vicinity of Garnet, Mackinac County, is estimated to have reserves of over 200,000,000 tons of high-purity stone (see analyses 47 and 48, table 3). Garnet is on the Minneapolis, St. Paul, & Sault Ste. Marie Railroad and is roughly 10 miles by truck road from Naubinway, a possible harbor development.

More than 3,000 acres in the vicinity of Ozark, Mackinac County, and Haff postoffice (Dick), Chippewa County, is underlain by nearly pure dolomite (see analyses 8 and 42, table 3). This area contains an estimated minimum of 200,000,000 tons of available stone near the Duluth, South Shore, & Atlantic Railway. Three large deposits 8 miles east of Ozark, around East Lake, are estimated to contain 630,000,000 tons. Analyses 36, 39-41, 43, and 44 (table 3) are from these areas. Improved gravel roads make these deposits accessible to both rail and water.

Four miles southeast of the mouth of Pine River, a harbor-development site is located within half a mile of an area of dolomite with reserves of 50,000,000 tons (see analysis 8, table 3).

Analyses 3 and 4 are representative of a large area east and north of McNamara, Mackinac County, with reserves of at least 350,000,000 tons. Analyses 6 and 7 are from two smaller areas totaling 60,000,000 tons of reserves a few miles south of the McNamara deposits. Several large deposits occur in the vicinity of McGregor and Patricks and south to Bush Bay and McKay Bay. Bush Bay is a possible site for a harbor development to serve this area. Analyses 64 to 67 are from these deposits, the estimated reserves of which total 350,000,000 tons.

Chippewa County contains large areas of Engadine dolomite, particularly on Drummond Island and on the mainland in the southeastern part of the county. Reserves of at least 15,000,000 tons of high-purity dolomite (see analysis 68) occur at Goetzville. Analysis 69 represents a deposit estimated at 7,000,000 tons 3 miles southeast of Goetzville. At Detour, a 10,000,000-ton deposit is favorably situated with respect to road and water (see analysis 70).

Immediately across Detour Passage from Detour at Old Fort Drummond on Drummond Island, a deposit of at least 45,000,000 tons occurs adjacent to a developed harbor and loading dock. The high quality of this dolomite is indicated by analyses 50 and 51 (table 3).

Farther east on the north shore of Huron Bay another deposit, estimated to contain 45,000,000 tons of high-grade rock, is accessible to a possible harbor development (see analyses 53 and 54, table 3). In the area around Scammon Cove the reserves of high-quality dolomite are estimated at 200,000,000 tons (analyses 57 to 61, table 3).

Schoolcraft, Chippewa, and Mackinac Counties contain virtually inexhaustible supplies of high-purity dolomite, large areas of which are readily accessible to rail or water transportation. Quarrying conditions are favorable at most of the above-mentioned localities, and overburden is light or absent.

Dolomite is also found in Wayne and Monroe Counties in southeastern Michigan (see analyses 68-76, table 3).

Illinois^{8/}

The best-quality dolomites in Illinois are found in the northern third of the State in the Niagaran series of Silurian age, the deposits in northeastern Illinois occurring principally in the Racine and Joliet formations and those in northwestern Illinois in the Waukesha, Racine, and Port Byron formations. They are approximately correlative with the Huntington of Indiana and the Engadine of northern Michigan. Dolomite of high purity also occurs in the Galena-Platteville formations of Ordovician age in the north-central and northwestern parts of the State.

High-purity Niagaran dolomites in the northeastern part of Illinois outcrop in parts of Cook, DuPage, Kankakee, and Will Counties. In the northwestern part

^{8/} Prepared in cooperation with the Illinois State Geological Survey.

of the State they occur in Carroll, Rock Island, and Whiteside Counties. Deposits in a small area in Calhoun and Jersey Counties in southwestern Illinois are also of Niagaran age. High-purity dolomite in the Galena-Platteville formations occurs in Boone, Carroll, Jo Daviess, Kendall, Lee, Ogle, Stephenson, Whiteside, and Winnebago Counties.

Much of the dolomite in northern Illinois is more or less deeply buried beneath a cover of glacial debris; however, outcrops are abundant along the rivers and streams and in upland areas where the glacial deposits have been eroded. In many areas the deposits are quite pure, extensive enough, and sufficiently close to the surface to be important.

The Chicago area has numerous deposits of high-purity dolomite, the principal ones being near Chicago, Chicago Heights, Elmhurst, Hillside, Hinsdale, LaGrange, McCook, and Sag Bridge. Some of them are being developed on a large scale, but undeveloped quarry sites are available. Individual deposits with relatively thin overburden contain as much as a square mile or more of good-quality rock 30 to 60 or more feet thick. The Niagaran strata in this area belong principally to the Racine formation. They attain a high degree of purity and, except for local reef structures, are nearly horizontal. Analyses 77 to 86 (table 3) show that impurities generally constitute less than 2 percent of the rock and that the magnesium carbonate content is uniformly high.

Several square miles of Racine dolomite with less than 10 feet of overburden occur in the vicinity of Kankakee, Kankakee County, south of Chicago, available to both the Illinois Central and New York Central Railroads. The maximum thickness exposed is 50 feet, but samples of cuttings from wells show that the high-purity strata probably are at least 150 feet thick in some places. Analyses 89 and 90 (table 3) indicate the presence of high-grade deposits.

In the Joliet area high-purity stone could be produced at Joliet, Romeo, New Lennox, Naperville, and Manhattan. The dolomite at Joliet, Romeo, and Naperville is part of the Joliet formation and is higher in impurities (analyses 91-93, table 3) than the high-grade Racine formation at New Lennox and Manhattan. At Romeo more than a square mile of dolomite has a thin overburden, but the deposit at Joliet would require selective quarrying, and at Naperville the quantity with a thin overburden may not be large. At New Lennox and Manhattan the deposits with a light overburden are probably not over 40 acres. Adequate transportation facilities are near at hand.

In northwestern Illinois high-purity Niagaran dolomite occurs near Savanna, Mount Carroll, Fulton, Morris, Albany, Garden Plain, Fenton, Cordova, Port Byron, and Hillsdale. At many of these places reserves of several million tons with only a thin soil and drift cover are available. The high-purity formations are over 100 feet thick, but at some deposits only 40 to 50 feet of stone is available. The strata are generally horizontal except for local reef structures and in the vicinity of Savanna, where they dip north at 5° to 10° . Analyses 94 to 98 (table 3) show the deposits to be uniformly high in magnesium carbonate and very low in impurities. Many deposits occur along railroads, and some are also close to water transportation on the Mississippi River.

High-purity dolomite in the Galena-Platteville formations is confined to certain chert-free zones 20 to 70 feet thick. It is commonly less pure than the Niagaran dolomite, although in a few places it compares favorably with the latter. Promising deposits, all near railroads, are at Belvidere, Boone County; Lanark, Milledgeville, and Mount Carroll, Carroll County; Elizabeth, Galena, and Warren, Jo Daviess County; Amboy and Dixon, Lee County; Adeline, Mount Morris, and Polo, Ogle County; Dakota, Evarts, Freeport, and Ridott, Stephenson County; and Rockford and Seward, Winnebago County. Many of them cover 160 acres or more and have a relatively thin overburden. Reserves of many millions of tons are available at several of these localities. The attitude of the beds is predominately horizontal. Analyses 99 to 104 (table 3) show the composition of the high-purity beds in the Galena-Platteville dolomites.

Indiana

Extensive deposits of high-purity dolomites are found in the northern half of Indiana in two general areas - an eastern one, including parts of Randolph, Delaware, Blackford, Adams, Wells, and Huntington Counties, and a western one, including White and parts of Cass, Carroll, Pulaski, and Jasper Counties. (Personal communication from the Indiana Geological Survey, March 1942.) Indiana dolomites are of Silurian age and belong to the Huntington formation, the equivalent of the Engadine dolomite in Michigan, the so-called "Niagaran" dolomites of Wisconsin and Illinois, and the Cedarville-Springfield sequence of northwestern Ohio. The Huntington is a light or cream-color granular dolomite of saccharoidal texture, typically massive when fresh and slabby when weathered. The outcrop area represents the southern rim of the Michigan Basin but modified to some extent by the Cincinnati arch. Although regional dips in the Huntington are low, averaging less than 15 feet a mile, coral reefs and various structural complications cause local dips of as much as 45° in various directions. The dolomite formation ranges from 50 to 100 feet in thickness and averages about 70 feet. Glacial drift obscures many of the outcrops, but over large areas the drift cover is only a few feet thick. Outcrops are confined almost exclusively to the banks of the Wabash and its tributaries, which in many places have cut through the glacial debris and into the underlying bedrock. Although the dolomite of the Huntington formation commonly grades laterally or vertically into limestone, large areas of high-purity stone are available. Quarry faces of uniform material range from 30 to 70 feet in height, and reserves of individual areas or quarries are measured in millions of tons of good-quality stone. Quarry sites are plentiful, as the area is traversed by a network of railways, power lines, and navigable streams.

Analyses 105 to 123 (table 3) show the composition of the Huntington dolomite. In all but six, impurities constitute less than 2 percent of the rock. High-purity dolomites have been or are being quarried at Delphi, Carroll County (analyses 107 and 108); Huntington, Huntington County (analyses 111-115); Ridgeville, Randolph County (analyses 117-119); Bluffton, Wells County (analyses 120 and 121); and Monon, White County (analysis 123).

Indiana appears to be supplied with high-purity dolomite adequate to meet any possible demands on its reserves. Quarry facilities already in operation can furnish at least 10,000 tons of rock daily.

TABLE 3. - Analyses of Michigan, Illinois, and Indiana dolomites

	1	2	3	4	5	6	7	8	9
MgCO ₃	45.78	44.55	43.00	43.06	42.77	43.23	44.22	45.43	47.22
R ₂ O ₃ ^{a/}	1.11	1.25	1.00	.39	.47	.32	.80	.13	.21
SiO ₂	.67	.76	-	.22	.23	.33	1.03	.16	.41
CaCO ₃	55.47	56.40	56.00	56.24	55.94	56.31	52.97	52.87	52.83

	10	11	12	13	14	15	16	17	18
MgCO ₃	47.03	46.13	47.33	46.59	46.36	46.81	46.47	47.02	44.99
R ₂ O ₃ ^{a/}	.29	.22	.23	.14	.23	.21	.16	.33	.16
SiO ₂	.44	.46	.42	.27	.58	.34	.24	.54	.34
CaCO ₃	52.99	52.36	52.84	52.27	52.40	53.22	53.28	53.17	51.26

	19	20	21	22	23	24	25	26	27
MgCO ₃	46.21	46.48	47.08	42.75	43.89	44.85	46.66	43.71	44.00
R ₂ O ₃ ^{a/}	.20	.39	.34	.88	1.00	.32	.28	.55	-
SiO ₂	.72	.82	.82	.41	.40	.87	1.03	.70	-
CaCO ₃	52.29	52.62	52.53	53.83	54.73	56.35	54.38	54.81	55.00

	28	29	30	31	32	33	34	35	36
MgCO ₃	44.00	45.30	43.82	44.90	45.38	45.83	44.46	45.54	43.99
R ₂ O ₃ ^{a/}	1.00	.80	.75	.21	.33	.37	.13	.60	.89
SiO ₂	2.00	1.90	2.32	.16	1.02	.50	.20	.95	2.88
CaCO ₃	53.00	51.57	49.29	50.98	52.18	52.41	51.16	52.25	50.25

a/ Fe₂O₃ and Al₂O₃.

TABLE 3. - Analyses of Michigan, Illinois, and Indiana dolomites (Cont'd.)

	37	38	39	40	41	42	43	44	45
MgCO ₃	45.75	45.37	44.59	45.45	46.07	46.03	45.90	46.10	46.58
R ₂ O ₃ ^{a/}	.26	.24	.20	.15	.39	.14	.15	.39	.18
SiO ₂	.69	.15	.32	.15	.65	.18	.17	.57	.17
CaCO ₃	52.35	51.64	51.73	52.26	52.95	51.66	51.86	51.84	52.77

	46	47	48	49	50	51	52	53	54
MgCO ₃	46.96	44.46	46.43	45.62	46.24	46.70	45.35	45.31	46.83
R ₂ O ₃ ^{a/}	.35	.13	.08	.29	.21	.30	.21	.16	.29
SiO ₂	.33	.22	.12	.22	.79	.77	.23	.45	.81
CaCO ₃	52.74	51.22	52.73	51.27	53.19	53.36	51.88	51.49	52.94

	55	56	57	58	59	60	61	62	63
MgCO ₃	44.35	45.92	45.83	46.19	46.18	46.90	44.68	43.12	45.63
R ₂ O ₃ ^{a/}	.21	.35	.50	.20	.20	.30	.42	.51	.21
SiO ₂	.99	1.72	1.84	.82	.32	1.04	1.43	1.15	.66
CaCO ₃	53.01	53.02	52.27	52.18	51.76	52.97	54.44	54.94	54.44

	64	65	66	67	68	69	70	71	72
MgCO ₃	45.74	44.11	43.10	45.61	42.00	42.75	43.59	42.84	42.17
R ₂ O ₃ ^{a/}	.41	.62	1.33	1.31	-	.7	.98	.58	.48
SiO ₂	2.34	.45	1.54	1.13	.4	2.0	.74	1.33	2.32
CaCO ₃	54.15	58.35	54.05	54.79	54.00	54.54	54.57	54.94	55.03

^{a/} Fe₂O₃ and Al₂O₃.

TABLE 3. - Analyses of Michigan, Illinois, and Indiana dolomites (Cont'd.)

	73	74	75	76	77	78	79	80	81
MgCO ₃	43.53	44.59	45.01	-	-	43.13	43.93	-	-
MgO	-	-	-	19.95	21.92	-	-	21.63	21.91
R ₂ O ₃ ^{a/}	-	.31	.20	.95	.76	1.66	.31	.68	.76
SiO ₂	-	3.05	3.45	3.07	.32	1.04	.28	.28	.36
CaCO ₃	50.12	52.72	51.69	-	-	54.82	55.38	-	-
CaO	-	-	-	29.72	30.33	-	-	30.77	30.47
CO ₂	-	-	-	45.31	46.96	-	-	46.62	46.76

	82	83	84	85	86	87	88	89	90
MgCO ₃	-	-	45.22	42.96	-	-	-	-	-
MgO	21.23	21.32	-	-	20.45	21.47	20.74	21.52	21.16
R ₂ O ₃ ^{a/}	.77	.41	.90	.92	.49	.53	.90	.39	.68
SiO ₂	.84	.56	.70	1.23	.11	.27	1.20	.20	.65
CaCO ₃	-	-	53.41	54.04	-	-	-	-	-
CaO	30.33	30.87	-	-	31.20	30.65	30.48	30.59	30.57
CO ₂	46.39	46.85	-	-	47.05	47.07	46.04	47.27	46.46

	91	92	93	94	95	96	97	98	99
MgCO ₃	-	42.13	41.84	-	-	-	-	-	-
MgO	20.44	-	-	20.93	21.19	21.09	20.99	20.59	20.66
R ₂ O ₃ ^{a/}	.90	1.77	2.72	1.62	.93	.42	.46	.99	1.25
SiO ₂	1.29	1.99	1.90	.16	.33	.38	.10	.18	.98
CaCO ₃	-	53.73	52.61	-	-	-	-	-	-
CaO	30.70	-	-	31.03	30.62	30.47	31.31	31.84	30.91
CO ₂	46.30	-	-	46.61	46.70	47.18	47.35	47.16	46.77

^{a/} Fe₂O₃ and Al₂O₃.

TABLE 3. - Analyses of Michigan, Illinois, and Indiana dolomites (Cont'd.)

	100	101	102	103	104	105	106	107	108
MgCO ₃	-	-	-	-	-	45.00	43.10	44.60	43.92
MgO	20.59	20.60	21.20	21.36	21.15	-	-	-	-
R ₂ O ₃ ^{a/}	1.45	1.20	.72	.66	.73	.47	.52	1.70	.51
SiO ₂	1.80	1.16	.94	.26	.95	.53	1.14	1.11	.19
CaCO ₃	-	-	-	-	-	54.00	54.80	53.36	54.53
CaO	30.23	30.62	30.43	30.72	30.39	-	-	-	-
CO ₂	45.74	46.03	46.56	46.68	46.48	-	-	-	-

a/ Fe₂O₃ and Al₂O₃.Locations of samples in table 3

1. Upper 19 feet, Seaman quarry, Drummond Island, Chippewa County, Mich.
2. Lime Island, above St. Marys River, Chippewa County, Mich.
3. Point Detour, St. Marys River, Chippewa County, Mich.
4. Engadine dolomite, sec. 8, T. 42 N., R. 2 E., Chippewa County, Mich.
5. Lower 20 feet of Engadine, Ozark Road, sec. 29, T. 44 N., R. 5 W., Chippewa County, Mich.
6. Upper 30 foot bed of Engadine, Ozark Road, sec. 29, T. 44 N., R. 5 W., Chippewa County, Mich.
7. Sec. 20, T. 44 N., R. 5 W., Chippewa County, Mich.
8. NE $\frac{1}{4}$ sec. 32, T. 44 N., R. 5 W., Chippewa County, Mich.
9. Sec. 1, T. 41 N., R. 4 E., Chippewa County, Mich.
10. E $\frac{1}{2}$ sec. 36, T. 42 N., R. 4 E., Chippewa County, Mich.
11. E $\frac{1}{2}$ sec. 34, T. 42 N., R. 5 E., Chippewa County, Mich.
12. SE $\frac{1}{4}$ sec. 12, T. 41 N., R. 5 E., Chippewa County, Mich.
13. North shore of Pats Lake, NE $\frac{1}{4}$ sec. 7, T. 41 N., R. 6 E., Chippewa County, Mich.
14. E $\frac{1}{2}$ sec. 8, T. 41 N., R. 6 E., Chippewa County, Mich.
15. W $\frac{1}{2}$ sec. 3, T. 41 N., R. 6 E., Chippewa County, Mich.
16. E $\frac{1}{2}$ sec. 9, T. 41 N., R. 6 E., Chippewa County, Mich.
17. SW $\frac{1}{4}$ sec. 12, T. 41 N., R. 6 E., Chippewa County, Mich.
18. SW $\frac{1}{4}$ sec. 30, T. 43 N., R. 1 E., Chippewa County, Mich.
19. S $\frac{1}{2}$ sec. 5, T. 42 N., R. 3 E., Chippewa County, Mich.
20. NW $\frac{1}{4}$ sec. 23, T. 42 N., R. 3 E., Chippewa County, Mich.
21. NE $\frac{1}{4}$ sec. 34, T. 42 N., R. 4 E., $\frac{1}{2}$ mile NW of Detour, Chippewa County, Mich.
22. Engadine dolomite, Ozark, Mackinac County, Mich.
23. Ross property, Kenneth, Mackinac County, Mich.
24. Upper bed, 1 mile west of Engadine, Mackinac County, Mich.
25. Lower bed, 7 feet thick, 1 mile west of Engadine, Mackinac County, Mich.
26. Engadine dolomite, Engadine, Mackinac County, Mich.

Locations of samples in table 3 (Cont'd.)

27. East side of Mackinac Island, near water level, Mackinac County, Mich.
28. Bed of Carp River, $\frac{1}{2}$ mile from mouth, Mackinac County, Mich.
29. SE $\frac{1}{4}$ sec. 21, T. 42 N., R. 1 W., Mackinac County, Mich.
30. SW $\frac{1}{4}$ sec. 17, T. 42 N., R. 1 W., Mackinac County, Mich.
31. E $\frac{1}{2}$ sec. 28, T. 43 N., R. 2 W., Mackinac County, Mich.
32. SE $\frac{1}{4}$ sec. 9, T. 43 N., R. 2 W., Mackinac County, Mich.
33. SE $\frac{1}{4}$ sec. 10, T. 42 N., R. 2 W., Mackinac County, Mich.
34. Sec. 2, T. 42 N., R. 2 W., Mackinac County, Mich.
35. SW $\frac{1}{4}$ sec. 7, T. 42 N., R. 2 W., Mackinac County, Mich.
36. SE $\frac{1}{4}$ sec. 33, T. 43 N., R. 4 W., Mackinac County, Mich.
37. S $\frac{1}{2}$ sec. 11, T. 43 N., R. 4 W., Mackinac County, Mich.
38. SW $\frac{1}{4}$ sec. 21, T. 43 N., R. 3 W., Mackinac County, Mich.
39. NE $\frac{1}{4}$ sec. 3, T. 43 N., R. 4 W., Mackinac County, Mich.
40. Sec. 27, T. 43 N., R. 4 W., Mackinac County, Mich.
41. N $\frac{1}{2}$ sec. 29, T. 43 N., R. 4 W., Mackinac County, Mich.
42. NE $\frac{1}{4}$ sec. 17, T. 43 N., R. 5 W., Mackinac County, Mich.
43. W $\frac{1}{2}$ sec. 18, T. 43 N., R. 4 W., Mackinac County, Mich.
44. SW $\frac{1}{4}$ sec. 23, T. 43 N., R. 5 W., Mackinac County, Mich.
45. E $\frac{1}{2}$ sec. 28, T. 43 N., R. 5 W., Mackinac County, Mich.
46. SE $\frac{1}{4}$ sec. 30, T. 43 N., R. 5 W., Mackinac County, Mich.
47. S $\frac{1}{2}$ sec. 10, T. 43 N., R. 8 W., Mackinac County, Mich.
48. S $\frac{1}{2}$ sec. 33, T. 44 N., R. 8 W., Mackinac County, Mich.
49. S $\frac{1}{2}$ sec. 33, T. 44 N., R. 7 W., Mackinac County, Mich.
50. SE $\frac{1}{4}$ sec. 15, T. 42 N., R. 11 W., Mackinac County, Mich.
51. SE $\frac{1}{4}$ sec. 11, T. 42 N., R. 11 W., Mackinac County, Mich.
52. NW $\frac{1}{4}$ sec. 28, T. 42 N., R. 11 W., Mackinac County, Mich.
53. E $\frac{1}{2}$ sec. 13, T. 43 N., R. 11 W., Mackinac County, Mich.
54. N $\frac{1}{2}$ sec. 31, T. 43 N., R. 10 W., Mackinac County, Mich.
55. T. 43 N., R. 11 W., Mackinac County, Mich.
56. S $\frac{1}{2}$ sec. 10, T. 42 N., R. 1 E., Mackinac County, Mich.
57. SE $\frac{1}{4}$ sec. 28, T. 42 N., R. 1 E., Mackinac County, Mich.
58. N $\frac{1}{2}$ sec. 35, T. 42 N., R. 1 E., Mackinac County, Mich.
59. NW $\frac{1}{4}$ sec. 24, T. 42 N., R. 1 E., Mackinac County, Mich.
60. W $\frac{1}{2}$ sec. 11, T. 41 N., R. 13 W., Schoolcraft County, Mich.
61. 8-foot section, Manistique quarry, Manistique, Schoolcraft County, Mich.
62. 8-foot section, Marblehead quarry, secs. 35-36, T. 42 N., R. 15 W.,
Manistique, Schoolcraft County, Mich.
63. 6-foot ledge, sec. 20, T. 41 N., R. 17 W., Cocks, Schoolcraft County, Mich.
64. $1\frac{1}{2}$ miles north of Cocks, Schoolcraft County, Mich.
65. 12-foot section at top of cliff, sec. 9, T. 42 N., R. 14 W., Schoolcraft
County, Mich.
66. 20 foot from top of section in 65.
67. 30 feet from top of section in 65.
68. 2 miles north of Monroe, Monroe County, Mich.
73. Top 4 feet, Woolmish quarry, sec. 21, T. 5 S., R. 8 E., Monroe County, Mich.
74. 3-foot section, Woolmish quarry, sec. 21, T. 5 S., R. 8 E., Monroe County,
Mich.
75. 12-foot section, Grape quarry, Monroe, Monroe County, Mich.

Locations of samples in table 3 (Cont'd.)

76. Near Sunday Lake, Gogebic District, Gogebic County, Mich.
77. 30-foot section, Dolese & Shepard Co., McCook quarry, Cook County, Ill.
78. Average 36 analyses, Dolese & Shepard Co., McCook quarry, Cook County, Ill.
79. Average 6 analyses, Consumers Co., McCook quarry, Cook County, Ill.
80. 30-foot section, Consumers Co., quarry near LaGrange, Cook County, Ill.
81. 40-foot section, House of Correction quarry, Chicago, Cook County, Ill.
82. 50-foot section, Elmhurst-Chicago Stone Co., Elmhurst, DuPage County, Ill.
83. 40-foot section, Material Service Co., Stearns quarry, LaGrange, DuPage County, Ill.
84. 20-foot section, Material Service Co., Federal quarry, LaGrange, DuPage County, Ill.
85. Basal beds, Material Service Co., Thornton, Cook County, Ill.
86. 50-foot section, Material Service Co., Thornton, Cook County, Ill.
87. 15-foot section near Sag Bridge, Cook County, Ill.
88. 10-foot section near Chicago Heights, Cook County, Ill.
89. 12-foot section near Kankakee, Kankakee County, Ill.
90. 42-foot section near Kankakee, Kankakee County, Ill.
91. 8-foot section near Romeo, Will County, Ill.
- 92,93. Average analyses, 20-foot section, near Romeo, Will County, Ill.
94. 35-foot section near Savanna, Carroll County, Ill.
95. 30-foot section near Mt. Carroll, Carroll County, Ill.
96. 25-foot section, U. S. Gypsum Co., Cordova, Rock Island County, Ill.
97. 20-foot section near Albany, Whiteside County, Ill.
98. 40-foot section near Fulton, Whiteside County, Ill.
99. 21-foot section near Galena, Jo Daviess County, Ill.
100. 20-foot section near Warren, Jo Daviess County, Ill.
101. 25-foot section near Seward, Winnebago County, Ill.
102. 26-foot section near Rockford, Winnebago County, Ill.
103. 16-foot section near Dixon, Lee County, Ill.
104. 16-foot section near Freeport, Stephenson County, Ill.
105. Adams County, Ind.
106. $4\frac{1}{2}$ miles west of Celina, Adams County, Ind.
107. Delphi, Carroll County, Ind.
108. Harley Bros. quarry, Delphi, Carroll County, Ind.
109. France Stone Co. quarry, Keepport, Cass Co., Ind.
110. Yorktown, Delaware County, Ind.
111. Consolidated Lime Co., Huntington, Huntington County, Ind.
- 112,113. Kelley Island Lime & Transport Co., Huntington, Huntington County, Ind.
114. France Stone Co., Huntington, Huntington County, Ind.
115. Huntington, Huntington County, Ind.
116. Portland, Jay County, Ind.
- 117,118. France Stone Co., Ridgeville, Randolph County, Ind.
119. Ridgeville, Randolph County, Ind.
- 120,121. France Stone Co., Bluffton, Wells County, Ind.
122. Rensselaer, White County, Ind.
123. Monon, White County, Ind.

Wisconsin

High-purity dolomites in Wisconsin are found in the upper part of the Niagara group, correlating with the "Niagaran" in Illinois and the Engadine in Michigan. They outcrop along the eastern border of the State near the shore of Lake Michigan. Dolomites, generally of less purity, found in the Prairie du Chien or "Lower Magnesian" (Onondaga and Shakopee) and the Galena and Black River formations are located in a semicircular area on the western and southern sides of the State and on the eastern side, separated from Lake Michigan by the Niagara dolomites. Pre-Cambrian dolomites, found largely in the Gogebic District in northeastern Wisconsin, are usually quite impure.

The Niagara dolomite underlies all or nearly all of Door, Kewaunee, Manitowoc, Sheboygan, Ozaukee, Milwaukee, Racine, and Kenosha Counties, as well as the southeastern part of Brown County; all but the northwestern part of Calumet County; eastern Fond du Lac County; eastern Dodge County; all but the western part of Washington and Waukesha Counties; and the eastern part of Walworth County. The total thickness of the formation is reported to range from 200 to 500 feet, although not all of this thickness is composed of high-purity dolomite. The area underlain by the Niagaran strata is covered by glacial drift and debris and, to the east, by lake clays. However, in a number of areas the glacial cover is thin enough to allow economical quarrying. The Niagara dolomites appear, from available data, to be less consistent in purity, both stratigraphically and areally, than their equivalent strata in the rest of the Great Lakes region. They range from fine to medium-coarse in grain size, are white, pink, buff, or gray, and are generally thick-bedded. Weathered exposures are relatively high in impurities.

Available analyses from Door County, near Sturgeon Bay, indicate the presence of both high-grade rock and rock high in silica. (See analyses 32-37, table 4.) Analysis 58 indicates that the dolomite outcropping near Kewaunee (Kewaunee County) is of good quality. Elsewhere in this county glacial debris is thick and outcrops are scarce.

Lake clays and glacial drift obscure most of the dolomite in Manitowoc County, but at several points where this cover is thin or where the strata outcrop large quarries are in operation. Sizable reserves of high-quality stone are indicated. (See analyses 60-65, table 4.)

Analyses 87 to 97 show that the upper Niagara dolomites in Sheboygan County are of high purity. Because of the overburden of glacial debris outcrops are found mainly in the wave-cut bluffs along Lake Michigan and in stream bottoms. Reserves of high-grade stone appear to be quite large.

Good-quality dolomites are found in both Milwaukee and Ozaukee Counties along the lake. The western parts of these counties are largely covered by thick glacial drift. Analyses 70 and 72 to 74 (table 4) indicate the high-grade character of the rock at Cedarburg, Grafton, and Druecker. Analysis 66 is from Wauwatosa, Milwaukee County, from the Niagara dolomite, and analyses 67 and 68 are from the overlying Waubesa formation.

The western parts of Racine and Kenosha Counties are covered with a thick mantle of glacial debris, which becomes thinner to the east. Both counties are entirely underlain by the Niagara formation, but outcrops are confined to their eastern parts. Only two analyses of the Niagara are available from these counties - No. 57 (table 4), from the Beswick quarry in Kenosha County, and No. 78, from the Horlick quarry in Racine County. One quarry northwest of the city of Racine is reported to have a 100-foot quarry face of high-purity stone.

Analyses of dolomites in Walworth and Washington Counties are not available. Those in Walworth County are reported to belong to the Galena and Black River strata and to contain rather high percentages of silica and other impurities. At Rockfield, South Germantown, and West Bend, Washington County, the Niagara dolomite is high-grade enough to be used for most purposes. Abundant analyses are available from Lannon and Waukesha, Waukesha County (analyses 98-108), but all show a comparatively high percentage of impurities.

The eastern part of Dodge County is an upland underlain by the Niagara dolomite, and outcrops are not uncommon. The Galena and Black River dolomite that underlies the central and southern parts is generally high in impurities, as shown by analyses 18 and 19, although analysis 20 indicates higher-quality rock. Analyses 21 to 31 show the presence of high-grade stone near Nasbro and Knowles. Large reserves of excellent material are available from the eastern part of this county.

The "Lower Magnesian" and Galena and Black River dolomites underlie the central part of Fond du Lac County but are relatively impure. The eastern part of this county, however, contains some of the largest Niagara dolomite quarries in the State. Most of the quarries are near the western margin of the formation along a westward-facing escarpment. High-purity dolomites are available in large tonnages at Oakfield, Hamilton, Marblehead, and Taycheedah. (See analyses 38-48, table 4.)

The eastern half of Calumet County is underlain by Niagara dolomite, which outcrops chiefly in the cliffs bordering Lake Winnebago. Rock in the largest quarries at High Cliff, Brillion, and Hayton occurs in nearly horizontal beds 10 to more than 20 feet thick, and the overburden is thin. Analyses 5 to 13 from this county indicate that the dolomites are generally high-grade.

Although available analyses from Brown County indicate rather impure dolomites (see analyses 1 and 2), the Niagaran strata in the eastern part may contain high-quality stone in considerable quantities.

The best possibilities for extensive development in this region are where water transportation on the Great Lakes is available. The overburden is generally heavy, but by careful selection sizable areas can be located where the drift cover is thin or absent.

TABLE 4. - Analyses of Wisconsin dolomites

	1	2	3	4	5	6	7	8	9
MgCO ₃	44.58	40.79	42.19	42.60	-	44.23	44.90	-	44.60
MgO	-	-	-	-	20.5	-	-	20.8	-
R ₂ O ₃ ^{a/}	1.95	.94	1.06	.79	1.4	.43	.22	.55	.30
SiO ₂	3.17	5.70	4.53	2.36	1.6	1.23	1.12	.45	.90
CaCO ₃	49.97	51.90	51.94	54.26	-	53.95	53.80	-	54.20
CaO	-	-	-	-	30.3	-	-	31.1	-

	10	11	12	13	14	15	16	17	18
MgCO ₃	42.40	44.20	44.40	43.96	40.40	40.85	40.60	40.08	40.40
R ₂ O ₃ ^{a/}	.26	.20	-	.36	.40	1.06	.79	1.75	1.24
SiO ₂	1.84	.73	1.40	.59	9.65	3.93	7.31	6.00	2.84
CaCO ₃	55.00	53.90	53.25	55.09	49.45	54.75	51.40	52.18	55.44

	19	20	21	22	23	24	25	26	27
MgCO ₃	43.90	44.14	39.60	45.54	44.75	44.70	43.80	43.90	44.00
R ₂ O ₃ ^{a/}	.22	.24	2.64	.90	.38	.36	1.29	.24	.28
SiO ₂	2.70	1.57	2.50	-	.41	.57	1.26	.70	.63
CaCO ₃	53.00	54.05	53.20	52.51	54.60	54.70	53.60	54.50	54.90

	28	29	30	31	32	33	34	35	36
MgCO ₃	43.00	45.07	-	45.32	44.17	-	43.70	41.90	42.10
MgO	-	-	21.4	-	-	20.56	-	-	-
R ₂ O ₃ ^{a/}	.60	.01	.45	.24	.33	1.06	.45	.35	.40
SiO ₂	2.52	.02	.55	.28	1.09	.43	3.04	5.27	1.68
CaCO ₃	53.55	54.74	-	54.3	54.42	-	52.80	51.95	53.75
CaO	-	-	30.7	-	-	30.70	-	-	-
CO ₂	-	-	47.0	-	-	-	-	-	-

a/ Fe₂O₃ and Al₂O₃.

TABLE 4. - Analyses of Wisconsin dolomites (Cont'd.)

	37	38	39	40	41	42	43	44	45
MgCO ₃	43.56	44.48	43.00	44.00	-	44.25	44.25	43.70	44.25
MgO	-	-	-	-	21.2	-	-	-	-
R ₂ O ₃ ^{a/}	1.29	.36	.69	.45	.35	.20	.57	.40	.24
SiO ₂	3.40	.67	1.48	1.06	.45	.94	.84	1.13	.66
CaCO ₃	50.93	54.25	54.00	54.45	-	54.50	54.25	54.90	54.90
CaO	-	-	-	-	30.8	-	-	-	-
CO ₂	-	-	-	-	47.2	-	-	-	-

	46	47	48	49	50	51	52	53	54
MgCO ₃	43.54	44.43	44.34	40.93	45.25	42.80	41.00	40.75	-
MgO	-	-	-	-	-	-	-	-	20.68
R ₂ O ₃ ^{a/}	.59	.48	.31	3.69	.48	1.13	.90	.78	.78
SiO ₂	2.12	.69	.26	3.16	1.37	2.31	5.38	7.28	.63
CaCO ₃	53.51	54.40	55.08	51.68	53.20	54.25	53.35	51.50	-
CaO	-	-	-	-	-	-	-	-	30.94
CO ₂	-	-	-	-	-	-	-	-	46.27

	55	56	57	58	59	60	61	62	63
MgCO ₃	42.40	43.00	43.52	42.70	40.20	44.00	43.50	43.80	44.39
R ₂ O ₃ ^{a/}	1.11	.57	.92	.42	1.16	.7	.27	.30	.58
SiO ₂	4.80	3.94	.48	1.34	3.30	2.5	.96	.81	.24
CaCO ₃	52.20	51.54	55.23	54.65	54.40	52.8	54.95	54.30	54.38

a/ Fe₂O₃ and Al₂O₃.

TABLE 4. - Analyses of Wisconsin dolomites (Cont'd.)

	64	65	66	67	68	69	70	71	72
MgCO ₃	43.94	44.39	43.15	43.41	41.82	44.6	-	40.20	45.34
MgO	-	-	-	-	-	-	22.88	-	-
R ₂ O ^{a/}	.93	.58	.40	.51	2.01	2.00	.30	1.20	.92
SiO ₂	.86	.24	1.50	1.49	1.50	1.6	-	8.76	.99
CaCO ₃	54.31	54.38	55.00	54.56	54.69	51.8	-	49.50	52.57
CaO	-	-	-	-	-	-	32.20	-	-
CO ₂	-	-	-	-	-	-	44.62	-	-

	73	74	75	76	77	78	79	80	81
MgCO ₃	43.60	43.48	40.00	40.55	42.8	45.50	43.87	42.80	43.70
R ₂ O ^{a/}	.28	.61	2.20	1.24	2.6	.82	1.42	.10	1.07
SiO ₂	1.15	.5	2.10	6.00	1.4	.28	5.41	4.48	3.16
CaCO ₃	54.50	55.41	55.05	52.10	52.9	52.16	49.30	52.60	53.00

	82	83	84	85	86	87	88	89	90
MgCO ₃	42.80	42.6	41.50	40.55	40.80	45.13	-	42.31	-
MgO	-	-	-	-	-	-	21.68	-	21.88
R ₂ O ^{a/}	1.72	4.2	2.02	7.75	5.72	.46	.06	1.1	.10
SiO ₂	.93	1.0	1.15	.76	.81	.89	.35	.46	-
CaCO ₃	54.75	52.2	54.55	50.75	51.85	53.52	-	55.49	-
CaO	-	-	-	-	-	-	30.11	-	30.80
CO ₂	-	-	-	-	-	-	47.25	-	47.40

a/ Fe₂O₃ and Al₂O₃.

TABLE 4. - Analyses of Wisconsin dolomites (Cont'd.)

	91	92	93	94	95	96	97	98	99
MgCO ₃	45.65	43.91	40.35	42.60	44.75	44.40	43.75	42.45	41.75
R ₂ O ₃ ^{a/}	1.10	.64	.93	.48	.28	.40	.55	.35	1.02
SiO ₂	.46	.55	.78	.30	.66	.92	1.86	4.40	6.32
CaCO ₃	52.17	55.09	56.22	55.00	54.50	53.25	53.85	50.35	50.96

	100	101	102	103	104	105	106	107	108
MgCO ₃	41.70	42.50	42.21	42.27	41.90	43.50	40.90	40.00	40.85
R ₂ O ₃ ^{a/}	.78	.46	.36	1.68	.57	.42	.77	.89	.69
SiO ₂	4.32	5.96	5.20	3.96	6.16	1.76	3.27	8.14	8.20
CaCO ₃	53.25	52.25	51.24	52.29	51.50	54.25	54.25	51.40	50.75

	109	110	111
MgCO ₃	41.05	42.60	42.91
R ₂ O ₃ ^{a/}	.50	1.05	2.00
SiO ₂	7.64	2.46	3.01
CaCO ₃	50.75	53.75	51.97
^{a/} Fe ₂ O ₃ and Al ₂ O ₃ .			

Locations of samples in table 4

1. Duck Creek, Brown County.
2. 40-foot section north of Fountain City, Brown County.
3. 10-foot section north of Alma, Buffalo County.
4. 12-foot section north of Alma, Buffalo County.
5. Western Lime & Cement Co., High Cliff, Calumet County.
6. Lower 20 feet of Niagara dolomite, High Cliff, Calumet County.
7. 12-foot section at bottom of quarry, Hayton, Calumet County.
8. Western Lime and Cement Co., Brillion, Calumet County.
9. Top 25 feet of quarry at Brillion, Calumet County.
10. 10-foot section below No. 9.
11. 4-foot section below No. 9.
12. 10-foot section below No. 9.
13. Brillion, Calumet County.
14. 4 feet in bottom of quarry, Columbus, Columbia County.
15. Top 12 feet, Lewis quarry, Crawford County.

Locations of samples in table 4 (Cont'd.)

16. 10-foot section of Lower Magnesian dolomite, Clayson quarry, Soldiers Grove.
17. 12-foot section of Kelly quarry, Oregon, Dane County.
18. Cowan quarry, sec. 28, T. 9 N., R. 15 E., Dodge County.
19. Tezloff quarry, lower 12 feet, Dodge County.
20. 15 feet of dolomite in quarry, sec. 20, T. 9 N., R. 15 E., Dodge County.
21. 35 feet of dolomite at Iron Ridge, Dodge County.
22. Mayville White Lime Co., Mayville, Dodge County.
- 23-26. Mayville White Lime Co., sec. 1, T. 11 N., R. 16 E., Dodge County.
27. Lower 10 feet in Western Lime Co. quarry; Nasbro, Dodge County.
28. Upper 15 feet in Western Lime Co. quarry, Nasbro, Dodge County.
29. Standard Lime & Stone Co., Knowles, Dodge County.
30. Western Lime & Cement Co., Knowles, Dodge County.
31. Knowles, Dodge County.
32. Sturgeon Bay, Door County.
33. Sturgeon Bay, Door County. (average of 9 analyses)
34. Upper 15 feet Smith quarry, northwest of Sturgeon Bay, Door County.
35. Middle 15 feet, Smith quarry, northwest of Sturgeon Bay, Door County.
36. Lower 25 feet, Smith quarry, northwest of Sturgeon Bay, Door County.
37. Sturgeon Bay, Door County.
38. Top strata, Western Lime & Cement Co. quarry, Hamilton, Fond du Lac County.
39. 25-foot section below No. 38.
40. 20-foot section below No. 39.
41. Western Lime & Cement Co., Marblehead, Fond du Lac County.
42. Bottom 25 feet, Western Lime & Cement Co., Marblehead, Fond du Lac County.
43. Next 15 feet above No. 42.
44. Next 10 feet above No. 43.
45. Next 10 feet above No. 44.
46. Niagara dolomite at Marblehead, Fond du Lac County.
47. Niagara dolomite at Oakfield, Fond du Lac County.
48. Niagara dolomite at Taycheedah, Fond du Lac County.
49. Lower Magnesian limestone, Ripon, Fond du Lac County.
50. Top 12 feet, Lower Magnesian dolomite at mouth of Green River, Grant County.
51. Next 12 feet below No. 50.
52. Next 16 feet below No. 51.
53. 30 feet near base of section of No. 50.
54. Penoque Region, NW $\frac{1}{4}$ sec. 22, T. 44 N., R. 5 W., Iron County.
55. John Luneck quarry, sec. 20, T. 7 N., R. 14 E., Jefferson County.
56. Lower 10 feet in quarry, Jefferson County.
57. Beswick quarry, Kenosha County.
58. 10-foot section, Western Lime & Cement Co. quarry, sec. 14, T. 23N, R. 24 E., Kewaunee County.
59. Lower 15 feet, J. H. Wall quarry, Darlington, Lafayette County.
60. Rockwell Lime Co., Manitowoc, Manitowoc County.
61. Upper 6 feet, Western Lime & Cement Co. quarry, Grimms, Manitowoc County.

Locations of samples in table 4 (Cont'd.)

62. Lower 20 feet, Western Lime & Cement Co. quarry, Grimms, Manitowoc County.
63. Standard Lime & Stone Co., quarry, Manitowoc County.
64. Maribel Springs Co. quarry, Coopertown, Manitowoc County.
65. Standard Lime & Stone Co., Valdars, Manitowoc County.
66. 26-foot face, Wauwatosa Stone & Coal Co., Wauwatosa, Milwaukee County.
- 67,68. Waubakee dolomite, Milwaukee County.
69. 22-foot face, Outagamie Limestone Co. quarry, Outagamie County.
70. Jno. F. Groth & Son quarry, Cedarburg, Ozaukee County.
71. 10-foot section, Lindauer quarry, Kaukauna, Outagamie County.
72. Grafton, Ozaukee County.
73. Upper 20 feet of Niagara dolomite, Grafton, Ozaukee County.
74. Independent Lime & Stone Co., Druecker, Ozaukee County.
75. Lower 8 feet of Lower Magnesian dolomite, Clifton, Pierce County.
76. 20-foot section above No. 76.
77. Top 30 feet of beds along Apple River, west of Little Falls, Polk County.
78. Horlick quarry, Racine County.
79. 19-foot section in Carpenter quarry, Rock County.
80. Top 17 feet, Andrew Barren quarry, Rock County.
81. Bottom 10 feet, Andrew Barren quarry, Rock County.
- 82-83. Quarry near Wilson, St. Croix County.
- 84-85. 23 feet in quarry, Ferry Bluff, Sauk County.
86. 9 feet in quarry, Mill Bluff, Sauk County.
87. Valdars Lime & Stone Co., Elkhart Lake, Sheboygan County.
88. Sheboygan Lime Works, Sheboygan, Sheboygan County.
89. Sheboygan, Sheboygan County.
90. Sheboygan Lime Works, Sheboygan, Sheboygan County.
- 91-92. Sheboygan Lime Works, sec. 9, T. 15 N., R. 15 E., Sheboygan County.
93. Top 20 feet, Sheboygan Lime Works, sec. 9, T. 15 N., R. 15 E., Sheboygan County.
- 94-97. 16 $\frac{1}{2}$ feet, Falls Lime & Stone Co. quarry, Sheboygan Falls, Sheboygan County.
- 98-99. 15 feet, Lee Bros. quarry, Genessee, Waukesha County.
100. Lower 15 feet, R.H. Gunz quarry, Lannon, Waukesha County.
101. Upper 25 feet, R.H. Gunz quarry, Lannon, Waukesha County.
102. Lannon Stone Co., Lannon, Waukesha County.
103. Lannon, Waukesha County.
104. 8-foot section, Weaver's quarry, Lisbon, Waukesha County.
105. Lower 15 feet, Templeton Lime & Stone Co., sec. 26, T. 8 N., R. 19 E., Waukesha County.
106. Upper 15 feet, Templeton Lime & Stone Co., sec. 26, T. 8 N., R. 19 E., Waukesha County.
107. Lower 15 feet, Waukesha Lime & Stone Co., $\frac{1}{2}$ mile north of Waukesha, Waukesha County.
108. Top 5 feet, Waukesha Lime & Stone Co., $\frac{1}{2}$ mile north of Waukesha, Waukesha County.
109. 37 foot section, Lutz quarry, Oskosh, Winnebago County.
110. Upper 6 feet, Salter quarry, west of Neenah, Winnebago County.
111. Winnebago County.

Ohio

Virtually unlimited supplies of high-purity dolomites are available in the western half of Ohio, where they underlie several thousand square miles. The dolomite strata are upper Silurian in age, belonging to the upper half of the Niagara group and to the overlying Monroe formation. The Niagara dolomites are equivalent to the Engadino of northern Michigan and the Huntington of Indiana; the Monroe strata correlate with the dolomites of Monroe and Wayne Counties in southeastern Michigan. As shown in figure 1, the northwest boundary of the dolomites in Ohio is in the form of an arc, with its concave side toward the center of the Lower Peninsula of Michigan. This and the fact that the dips are northwest indicate the influence of the Michigan Basin on these beds. However, farther east and south the strata owe their dips primarily to the Cincinnati arch, a very large, low swell trending north by northeast. The beds dip away from the arch on both sides at low angles and outcrop over a large area. Local domes and depressions on the arch or on its flanks cause variations and reversals of dip in some areas, but dips are never steep enough to constitute a major quarrying problem. Likewise, faulting, if present in the Silurian formations, is of small magnitude and offers little or no difficulty.

The dolomites belonging to the Niagara group include the Cedarville and Springfield formations, both of which are of superior purity and maintain their high quality throughout their stratigraphic thickness and areal extent. Wherever these formations have been sampled and analyzed they have been found to carry a high proportion of magnesia, generally in excess of 43 percent, and to contain usually less than 2 percent total impurities. The dolomites of the Springfield formation are massive, earthy, and buff-colored. The Cedarville stone is thinner-bedded and more porous but identical in chemical composition with the Springfield beds. These strata underlie all or part of the surface in the following counties: Lucas, Ottawa, Sandusky, Seneca, Hancock, Hardin, Wood, Mercer, Darke, Miami, Auglaize, Shelby, Logan, Clarke, Fayette, Greene, Adams, Highland, and Clinton.

The Monroe formation, sometimes known as the "Waterline," overlies the Cedarville-Springfield strata and often is separated from them by a thin layer of sandstone. The Monroe is confined largely to the west and northwest parts of the State and does not reach as far south as the Niagara beds. It is the predominating or only surficial formation in Paulding, Van Wert, Putnam, Allen, Lucas, Wood, Hancock, Harding, Wyandot, Logan, Union, Champaign, and Madison Counties and is also represented in Mercer, Auglaize, Henry, Ottawa, Sandusky, Seneca, Marion, Delaware, and Fayette Counties. In a considerable part of this area, however, the topography is flat, exposures are few, and drift and soil cover the bedrock. Chemically the formation is consistently dolomitic over large areas but in a few places grades into a high-silica dolomite. Its composition is not as constant areally or stratigraphically as the upper Niagara beds, but large quantities of nearly pure dolomite are available. The Monroe dolomite ranges from an earthy, dirty-brown, rather soft stone, through a light-gray, porous phase showing large crystals, to a hard, dense, bluish rock.

The thickness of the soil and glacial cover on the bedrock is an important factor to be considered in locating a dolomite quarry in Ohio. In some counties,

notably the western and northwestern, the drift is rather heavy. However, there are many areas where bedrock outcrops or is within a few feet of the surface. The structure of the dolomite formations introduces few if any quarrying problems, and the composition of the rock, particularly the Niagara, is so constant that selective quarrying is seldom necessary.

Adams County lies on the eastern edge of the great limestone area of the western half of the State. In the western part of the county the Niagara group comprises the mass and tops of hills, but a large part of this is the lower Niagara and is not as pure as the upper part. As indicated by analyses 1 to 4 (table 5) the quality of the dolomite is not promising. Only analyses 3 and 4, representing the upper Niagara, indicate high-purity material.

Analyses 5 and 6 of upper Niagara and Monroe dolomite in Pike County indicate excellent quality. However, dolomite is found only in a small arcuate area in the northwest, and reserves are not large.

A small area on the western edge of Ross County contains high-purity dolomite both in the Monroe formation and the upper Niagara strata. (See analyses 7-10.)

Analyses 12 to 17 of the upper Niagara Peebles, Lilley, and Cedarville beds show the presence of excellent-quality dolomite in Highland County. Analyses 11 and 18 to 22 are too high in impurities to be classed as high-grade, and all but the first belong to the Monroe formation. The best dolomites are in the eastern and central parts near Sinking Springs, Fallsville, Samantha, Greenfield, and Willettsville, where high-grade rock up to 32 feet in thickness is found.

Dolomites in Fayette County appear to be rather impure. (See analyses 23-27.) However, this does not preclude the possibility of finding good-grade dolomite in commercial quantities. The Niagara and Monroe strata underlie the entire county - the Niagara on the west and the Monroe on the east.

Eastern Greene County (see analyses 28-38) has large supplies of high-purity Niagara dolomites. At Cedarville one quarry face is 34 feet high. Dolomites at Jamestown, Yellow Spring, and Monroe also have been analyzed and found to be of high quality.

Niagara dolomites underlie all of Darke County on the western edge of the State. West of Greenville and near Weavers, quarry samples show a nearly pure dolomite (analyses 39 and 42). Analyses 40 and 41 indicate a higher silica phase and probably represent the lower Niagara strata.

Analyses 43 and 44, both from Miami County, show exceptionally good grades of stone, the former a 19-foot bed near Covington, and the latter an 11-foot bed near Clayton. Since much of the County is underlain by dolomite of high purity it is possible that considerable reserves are available.

The bulk of the surface of Clarke County is covered with Niagara formation, and a band of Monroe dolomite is found in the northeast part. Both the upper and lower parts of the Niagara are well-represented here, although only the former is of uniformly high quality. Analyses 45 to 56 (table 5), with the exception of No. 49, indicate the excellent quality of the stone found in the vicinity of Springfield, Durbin, and Cold Springs and in Mad River Township. High-silica dolomite (analysis 49) probably representing the lower Niagara beds occurs in the latter area. Other analyses, published in reports of the Ohio Geological Survey, also show that high-silica dolomites predominate in the lower strata. Large tonnages of high-quality stone could be quarried in Clarke County at many points where the drift cover is relatively thin or absent.

The single analysis (No. 57) available from Union County represents 26 feet of the Monroe formation in a quarry near York Center. It is fairly high grade dolomite, but the quality of the variable Monroe formation cannot be judged from a single analysis.

Champaign County dolomites are likewise represented by a single analysis, and even though it shows over 4 percent impurities one may infer that high-grade dolomite is present because the county is underlain by both upper Niagara and Monroe beds. Data on available quarry sites are lacking.

In Logan County, upper Niagara beds underlie Miami, Pleasant, Bloomfield, and Stokes Townships, and although no analyses are available, from the high quality of these beds in other areas one may conclude that high-purity dolomites probably are present. Analyses 59 to 69, from large deposits in the central and eastern parts of the county, represent the Monroe strata exclusively. All but No. 66 are too high in silica and other impurities for the more exacting uses.

Analysis 70 shows the exceptionally high quality of the Niagara dolomite in a 16-foot exposure in Orange Township, Shelby County. No other analyses are available, but it is reasonably certain that dolomites in the eastern and northern parts of the county are of equal purity. Extensive supplies are accessible where ravines have cut through the mantle of glacial drift.

Mercer County is entirely underlain by Niagara beds, except for a small area of Monroe formation in the northeast corner. Analyses from Jefferson and Dublin Townships (71 to 75) reveal the presence of exceptionally high grade dolomites, but the heavy overburden of glacial drift would greatly impede quarrying, except near Rockford and west of Celina.

Most of Hardin County is underlain by Monroe beds, although a large area of upper Niagaran strata occurs in the northeast and a smaller one at the extreme west. Analyses 77, 79, and 87 represent the high-grade dolomites of the upper Niagara beds in the vicinity of Forest. Analysis 78, of beds immediately below those represented by No. 77, shows a high silica content and is probably from the lower Niagara. The Monroe formation in this county is not as pure as the upper Niagara; it generally contains 2 percent or more impurities (analyses 76, 80-86). Abundant reserves of both types of stone are available. Large quarries at Kenton (Monroe beds) and Forest (upper Niagara) make this one of the important stone-producing counties in Ohio.

The western half of Marion County is underlain by the Monroe formation. The one available analysis (No. 88) represents 17 feet of high-purity dolomite. No further information on quality is available, but suitable quarry sites may be found along the several streams in the western and central parts.

Wyandot County is rich in dolomite resources, the western quarter being underlain by upper Niagara beds and the middle half by Monroe strata. The dolomite-quarrying industry is centered in Crawford Township near Carey (analyses 89-94 and 98). Analysis 91 represents 12 feet of low-grade Monroe formation, but the 32 feet of underlying Niagara is of such high purity that an average composition of the entire quarry face falls within the limits of high-quality dolomite. Analyses 95 to 97 show that the stone near Upper Sandusky (Monroe formation) is high in silica. Large reserves of high-grade Niagara dolomite are available in the west and northwest part.

Allen County is underlain by the Monroe formation, except for a small patch of high-grade Niagara dolomite exposed in southern Auglaize Township, represented by analyses 99 to 101. Analyses 102 to 110 of the Monroe formation near Lima and Eluffton exhibit the characteristic variations of this formation from good to mediocre, which, with a few notable exceptions, disqualify it for high-grade uses in many areas.

A 60-foot bed of high-quality dolomite in the Monroe formation (analyses 111 and 112) quarried at Delphos, Van Wert County, is one of the exceptions to the above generalization, and other exceptions are the high-grade dolomites at Convoy, Middlepoint, and Van Wert. (Analyses 113-122.) Stone of this quality may be found at many other points in the county. No analyses of the upper Niagara covering the southeast quarter of the county are available, but it is probably of good quality.

Except for a 28-foot bed of high-grade dolomite at Grover Hill, Washington Township, represented by analyses 123 to 125, little information is available on the numerous exposures of the Monroe formation in the southern half of Paulding County.

Analyses 126 to 130 indicate that the Monroe dolomite at Rinner and near Pandora, Putnam County, is high in silica and other impurities. Further sampling along streams in the western and southern parts of the county may show deposits of Monroe dolomite comparable in purity to the Van Wert County material. No upper Niagara strata outcrop in this county.

The Niagara occupies the eastern half of Hancock County and the Monroe the western half. Analyses 132 to 135 are from the Monroe formation in the south-central part and are rather high in silica, although No. 134 from Arlington is a high-purity dolomite. At Findlay a large quarry has been opened in the high-grade upper Niagara strata represented by analyses 136 and 137. A large part of the county is covered by glacial drift so thick that quarrying is uneconomical at most localities except near Findlay and the area to the south.

High-quality dolomite is available in large tonnages at Bettsville, Maple Grove, Tiffin, Fostoria, and Bascom, Seneca County. The western third of the

county is underlain by upper Niagara beds, the central part by the Monroe formation. Both appear to be uniformly high grade, as indicated in analyses 138 to 149. Sections as thick as 57 feet are uniform in quality, and very large reserves are present.

Sandusky County, directly north of Seneca County, is underlain by the same high-quality dolomites. Monroe and Niagara beds are found in four alternating north-south bands of approximately equal width. High-grade dolomite (analyses 149-170) is quarried extensively near Fremont, at Gibsonburg, and in the vicinity of Woodville. In only two of these analyses do the total impurities exceed 1 percent. Reserves are large.

Virtually inexhaustible supplies of both Niagara and Monroe dolomites underlie all of Wood County except the northwest corner. The Niagara is of uniformly excellent quality, but the Monroe beds, except in their lower part, appear to be high in silica. (Analyses 171-189.) High-grade stone is quarried near Rising Sun, Fostoria, and Bowling Green and at Luckey; quarry faces are over 60 feet high in some localities.

The eastern two-thirds of Lucas County is covered by the Monroe formation except for a narrow band of Niagara that crosses the county from north to south through Oregon Township. Large quarries are at Lucas, Sylvania, Silica, and Waterville, all in the Monroe formation. (Analyses 190-195.) As the analyses show, only the quarry at Silica, which has a 40-foot working face, has high-purity dolomite. By selective quarrying, the quarry at Sylvania, which has a 100-foot face, probably could furnish high-grade stone. Glacial drift is thick, and the flat topography makes drainage difficult in much of the area.

Ottawa County is underlain by a northward extension of the same alternating bands of Monroe and Niagara strata found in Sandusky County. Analyses 194 to 210 show less than 1 percent total impurities. The best deposits are near Genoa and at Clay Center, Limestone, Williston, and Rocky Ridge. Reserves are virtually inexhaustible.

TABLE 5. - Analyses of Ohio dolomites

	1	2	3	4	5	6	7	8	9
MgCO ₃	40.53	44.24	44.13	44.76	45.37	45.07	44.99	44.98	42.89
MgO	19.38	21.15	21.10	21.40	21.60	21.55	21.51	21.51	20.51
R ₂ O ₃ ^{a/}	2.25	1.27	1.14	.53	.45	.37	.48	.59	.65
SiO ₂	3.47	.92	.77	.24	.44	.40	.35	.40	3.10
CaO	29.16	29.55	29.72	30.18	30.10	30.16	30.09	29.99	29.20
CO ₂	44.44	46.74	46.81	47.34	47.29	47.25	47.16	47.10	45.65
^{a/} Fe ₂ O ₃ and Al ₂ O ₃ .									

TABLE 5. - Analyses of Ohio dolomites (Cont'd.)

	10	11	12	13	14	15	16	17	18
MgCO ₃	43.12	40.38	43.44	43.61	44.65	44.07	44.36	43.94	43.81
MgO	20.62	19.31	20.85	20.77	21.35	21.07	21.21	21.01	20.95
R ₂ O ₃ ^{a/}	.58	2.12	.74	.65	.71	.53	.40	.67	.46
SiO ₂	1.77	5.79	.95	.77	.33	.33	.20	.48	1.65
CaO	30.29	28.20	30.11	30.53	30.03	30.75	29.70	29.31	29.68
CO ₂	46.62	43.51	46.84	47.11	47.15	47.07	46.61	46.29	46.51

	19	20	21	22	23	24	25	26	27
MgCO ₃	42.42	44.87	41.77	45.77	43.44	41.72	44.69	43.17	43.40
MgO	-	-	-	-	20.77	19.95	21.37	20.64	20.75
R ₂ O ₃ ^{a/}	1.3	1.0	2.2	.9	1.41	2.70	.75	1.38	1.28
SiO ₂	2.44	4.43	1.6	3.57	2.55	4.61	1.01	3.55	3.07
CaCO ₃	53.67	49.9	54.1	49.76	-	-	-	-	-
CaO	-	-	-	-	29.09	27.95	29.80	28.84	28.96
CO ₂	-	-	-	-	45.60	43.86	46.80	45.32	45.55

	28	29	30	31	32	33	34	35	36
MgCO ₃	45.07	44.69	44.78	44.42	44.58	44.76	43.77	44.57	43.58
MgO	21.55	21.37	21.41	21.24	-	-	20.93	21.31	20.84
R ₂ O ₃ ^{a/}	.48	.58	.57	.91	.53	.57	.60	.53	.62
SiO ₂	.51	.65	.90	1.27	.88	.58	3.02	1.40	3.55
CaCO ₃	-	-	-	-	53.9	54.09	-	-	-
CaO	30.08	29.97	29.95	29.70	-	-	29.25	29.77	29.10
CO ₂	47.19	46.92	46.95	46.60	-	-	46.10	46.77	45.79

^{a/} Fe₂O₃ and Al₂O₃.

TABLE 5. - Analyses of Ohio dolomites (Cont'd.)

	37	38	39	40	41	42	43	44	45
MgCO ₃	41.12	43.38	44.80	44.69	45.26	44.76	45.20	45.22	44.94
MgO	-	-	21.42	-	-	21.40	21.61	21.62	-
R ₂ O ^{a/}	1.4	1.04	.20	-	-	.23	.31	.30	.23
SiO ₂	5.4	2.60	.06	4.6	2.7	.05	.40	.34	.49
CaCO ₃	51.1	53.02	-	50.11	51.7	-	-	-	54.05
CaO	-	-	30.78	-	-	30.75	30.10	30.16	-
CO ₂	-	-	47.56	-	-	47.53	47.31	47.38	-

	46	47	48	49	50	51	52	53	54
MgCO ₃	45.02	-	45.17	42.06	45.24	45.15	44.76	45.20	44.37
MgO	-	21.61	21.60	20.11	21.63	21.59	21.40	21.61	-
R ₂ O ^{a/}	.79	.12	.40	1.31	.37	.38	.60	.35	.56
SiO ₂	.91	.45	.33	5.75	.45	.44	.95	.43	.65
CaCO ₃	53.26	-	-	-	-	-	-	-	54.13
CaO	-	30.14	30.10	28.08	30.09	30.03	29.89	30.14	-
CO ₂	-	47.35	47.26	44.07	47.30	47.21	46.90	47.35	-

	55	56	57	58	59	60	61	62	63
MgCO ₃	43.79	44.03	44.84	43.51	42.56	39.84	43.35	44.94	44.17
MgO	-	-	21.44	20.80	20.35	19.05	20.73	21.49	21.12
R ₂ O ^{a/}	.39	.51	.40	1.14	.65	2.75	.70	.24	.37
SiO ₂	1.55	.56	1.40	3.11	3.65	5.79	2.17	1.07	1.98
CaCO ₃	53.88	54.92	-	-	-	-	-	-	-
CaO	-	-	29.80	29.05	29.50	28.20	29.82	30.04	29.70
CO ₂	-	-	46.86	45.50	45.47	43.04	46.10	46.98	46.34

^{a/} Fe₂O₃ and Al₂O₃.

TABLE 5. - Analyses of Ohio dolomites (Cont'd.)

	64	65	66	67	68	69	70	71	72
MgCO ₃	44.13	44.69	44.17	44.13	42.25	43.46	45.36	45.43	45.49
MgO	21.10	21.12	21.37	21.10	20.20	20.78	21.69	21.72	21.75
R ₂ O ₃ ^{a/}	.60	.23	.27	.49	.57	.33	.29	.31	.29
SiO ₂	1.80	2.97	1.60	1.82	5.56	4.07	.33	.15	.14
CaO	29.74	29.44	29.89	29.72	28.50	29.03	30.18	30.20	30.21
CO ₂	46.35	46.25	46.74	46.49	44.48	45.56	47.50	47.47	47.53

	73	74	75	76	77	78	79	80	81
MgCO ₃	44.15	45.43	45.49	44.55	45.59	43.21	-	42.48	43.88
MgO	-	21.72	21.75	21.30	21.80	20.66	21.95	-	20.98
R ₂ O ₃ ^{a/}	.10	.20	.19	.35	.12	.47	.28	2.01	.47
SiO ₂	.30	.19	.17	1.88	.05	4.66	-	2.51	2.35
CaCO ₃	55.45	-	-	-	-	-	-	52.51	-
CaO	-	30.17	30.21	29.70	30.38	28.75	29.79	-	29.50
CO ₂	-	47.43	47.47	46.62	47.64	45.21	-	-	46.06

	82	83	84	85	86	87	88	89	90
MgCO ₃	44.61	44.13	44.48	44.59	43.81	-	44.96	45.27	41.99
MgO	21.33	21.10	21.27	21.32	20.95	21.49	21.51	-	-
R ₂ O ₃ ^{a/}	.74	.84	.81	.72	1.02	.47	.27	.45	.31
SiO ₂	1.01	1.95	1.25	1.28	1.92	.54	.88	.10	.48
CaCO ₃	-	-	-	-	-	-	-	54.00	56.4
CaO	28.89	29.60	29.74	29.74	29.56	30.20	29.98	-	-
CO ₂	46.69	46.15	46.59	46.65	46.08	47.15	47.17	-	-

^{a/} Fe₂O₃ and Al₂O₃.

TABLE 5. - Analyses of Ohio dolomites (Cont'd.)

	172	173	174	175	176	177	178	179	180
MgCO ₃	45.28	45.34	43.75	44.96	44.82	44.91	44.9	45.66	44.02
MgO	21.65	21.68	-	21.50	21.43	-	-	21.83	-
R ₂ O ₃ ^{a/}	.52	.21	.50	.44	.73	.4	.36	.15	.58
SiO ₂	.19	.20	.38	.20	.30	.3	.45	.17	.38
CaCO ₃	-	-	55.35	-	-	53.88	54.1	-	54.83
CaO	30.15	30.17	-	30.22	30.25	-	-	30.36	-
CO ₂	47.38	47.40	-	47.08	46.95	-	-	47.69	-

	181	182	183	184	185	186	187	188	189
MgCO ₃	-	43.97	44.17	42.18	44.48	44.42	44.56	44.44	43.12
MgO	21.0	21.02	21.12	20.17	21.27	21.24	21.31	21.25	-
R ₂ O ₃ ^{a/}	.26	.39	.64	1.59	.31	.28	.32	.33	.69
SiO ₂	.24	.80	1.65	3.70	1.80	1.88	1.55	1.92	.84
CaCO ₃	-	-	-	-	-	-	-	-	55.23
CaO	31.1	29.23	29.37	29.01	29.77	29.74	29.86	29.70	-
CO ₂	47.5	46.01	46.20	44.90	46.60	46.50	46.72	46.51	-

	190	191	192	193	194	195	196	197	198
MgCO ₃	43.71	43.06	44.21	44.44	45.14	44.27	46.01	45.14	43.67
MgO	-	20.59	21.14	21.25	-	-	-	-	-
R ₂ O ₃ ^{a/}	.61	1.27	.82	.48	.16	.23	.51	.16	.42
SiO ₂	.62	2.11	2.14	1.77	.23	.04	.22	.23	.28
CaCO ₃	55.56	-	-	-	54.3	55.97	53.04	54.3	55.59
CaO	-	28.77	29.47	29.65	-	-	-	-	-
CO ₂	-	45.18	46.35	46.60	-	-	-	-	-

a/ Fe₂O₃ and Al₂O₃.

TABLE 5. - Analyses of Ohio dolomites (Cont'd.)

	118	119	120	121	122	123	124	125	126
MgCO ₃	44.90	44.53	45.01	45.15	45.43	45.30	45.01	45.15	45.28
MgO	21.47	21.29	21.52	21.59	21.72	21.66	21.52	21.59	21.65
R ₂ O ₃ ^{a/}	.51	.73	.31	.64	.28	.32	.34	.30	.22
SiO ₂	.84	1.38	.46	.33	.09	.40	.95	.65	.42
CaO	29.70	29.70	30.25	30.04	30.31	30.16	30.02	30.10	30.12
CO ₂	47.02	46.60	47.12	47.25	47.62	47.40	47.15	47.32	47.30

	127	128	129	130	131	132	133	134	135
MgCO ₃	44.34	44.17	44.15	44.34	43.79	44.36	44.42	44.65	44.61
MgO	21.20	21.12	21.11	21.20	-	21.21	21.24	21.35	21.33
R ₂ O ₃ ^{a/}	.59	.72	1.00	.89	.39	.45	.52	.52	.68
SiO ₂	1.70	1.81	1.95	1.51	1.55	1.95	1.75	1.01	1.06
CaCO ₃	-	-	-	-	53.88	-	-	-	-
CaO	29.71	29.65	29.46	29.61	-	29.65	29.70	30.01	29.98
CO ₂	46.47	46.29	46.17	46.40	-	46.45	46.44	46.80	46.79

	136	137	138	139	140	141	142	143	144
MgCO ₃	44.84	44.76	41.98	45.26	40.36	45.49	44	45.49	45.53
MgO	21.44	21.40	-	-	-	21.75	-	21.75	21.77
R ₂ O ₃ ^{a/}	.64	.63	.28	2.7	.17	.22	.60	.10	.05
SiO ₂	.83	1.41	.42	-	1.61	.25	.25	.18	.14
CaCO ₃	-	-	56.41	52.0	57.44	-	55	-	-
CaO	29.90	29.82	-	-	-	30.25	-	30.30	30.32
CO ₂	46.99	46.88	-	-	-	47.55	-	47.55	47.60

a/ Fe₂O₃ and Al₂O₃.

TABLE 5. - Analyses of Ohio dolomites (Cont'd.)

	145	146	147	148	149	150	151	152	153
MgCO ₃	45.42	42.54	43.48	43.33	45.79	46.39	42.18	45.20	45.15
MgO	21.72	-	20.79	20.72	-	-	20.17	21.61	21.59
R ₂ O ₃ ^{a/}	.10	.91	.34	.35	.39	.70	.22	.23	.24
SiO ₂	.18	.78	.35	.65	.31	.15	.86	.18	.19
CaCO ₃	-	54.29	-	-	53.5	52.76	-	-	-
CaO	30.28	-	29.00	28.92	-	-	28.35	30.40	30.42
CO ₂	47.53	-	45.49	45.38	-	-	44.30	47.47	47.01

	154	155	156	157	158	159	160	161	162
MgCO ₃	44.59	-	-	-	-	-	45.38	45.49	45.47
MgO	21.32	21.35	20.66	21.53	21.77	22.03	21.70	21.75	21.74
R ₂ O ₃ ^{a/}	.36	.42	.22	.05	.06	.10	.23	.16	.17
SiO ₂	1.09	.14	.14	.03	.16	.45	.10	.06	.05
CaO	29.77	30.39	29.5	30.60	30.48	30.7	30.34	30.33	30.30
CO ₂	46.59	47.56	49.38	47.70	47.54	-	47.48	47.59	47.59

	163	164	165	166	167	168	169	170	171
MgCO ₃	-	-	-	-	44.12	45.38	42.50	42.56	45.43
MgO	19.36	19.8	19.14	21.66	-	21.70	20.32	20.35	21.72
R ₂ O ₃ ^{a/}	.29	-	.39	.17	.13	.15	.24	.22	.34
SiO ₂	.12	.48	.16	.01	.22	.10	.34	.15	.14
CaCO ₃	-	-	-	-	55.54	-	-	-	-
CaO	32.94	31.88	32.87	30.97	-	30.18	28.28	28.35	30.20
CO ₂	47.20	47.82	-	47.47	-	47.38	44.43	44.55	47.47

^{a/} Fe₂O₃ and Al₂O₃.

TABLE 5. - Analyses of Ohio dolomites (Cont'd.)

	172	173	174	175	176	177	178	179	180
MgCO ₃	45.28	45.34	43.75	44.96	44.82	44.91	44.9	45.66	44.02
MgO	21.65	21.68	-	21.50	21.43	-	-	21.83	-
R ₂ O ₃ ^{a/}	.52	.21	.50	.44	.73	.4	.36	.15	.58
SiO ₂	.19	.20	.38	.20	.30	.3	.45	.17	.38
CaCO ₃	-	-	55.35	-	-	53.88	54.1	-	54.83
CaO	30.15	30.17	-	30.22	30.25	-	-	30.36	-
CO ₂	47.38	47.40	-	47.08	46.95	-	-	47.69	-

	181	182	183	184	185	186	187	188	189
MgCO ₃	-	43.97	44.17	42.18	44.48	44.42	44.56	44.44	43.12
MgO	21.0	21.02	21.12	20.17	21.27	21.24	21.31	21.25	-
R ₂ O ₃ ^{a/}	.26	.39	.64	1.59	.31	.28	.32	.33	.69
SiO ₂	.24	.80	1.65	3.70	1.80	1.88	1.55	1.92	.84
CaCO ₃	-	-	-	-	-	-	-	-	55.23
CaO	31.1	29.23	29.37	29.01	29.77	29.74	29.86	29.70	-
CO ₂	47.5	46.01	46.20	44.90	46.60	46.50	46.72	46.51	-

	190	191	192	193	194	195	196	197	198
MgCO ₃	43.71	43.06	44.21	44.44	45.14	44.27	46.01	45.14	43.67
MgO	-	20.59	21.14	21.25	-	-	-	-	-
R ₂ O ₃ ^{a/}	.61	1.27	.82	.48	.16	.23	.51	.16	.42
SiO ₂	.62	2.11	2.14	1.77	.23	.04	.22	.23	.28
CaCO ₃	55.56	-	-	-	54.3	55.97	53.04	54.3	55.59
CaO	-	28.77	29.47	29.65	-	-	-	-	-
CO ₂	-	45.18	46.35	46.60	-	-	-	-	-

a/ Fe₂O₃ and Al₂O₃.

TABLE 5. - Analyses of Ohio dolomites (Cont'd.)

	199	200	201	202	203	204	205	206	207
MgCO ₃	45.05	-	44.17	44.80	43.96	44.96	44.71	44.21	44.25
MgO	-	20.3	21.12	-	21.02	21.50	21.38	21.14	21.16
R ₂ O ₃ ^{a/}	.44	.25	.17	.20	.18	.17	.18	.18	.18
SiO ₂	.24	.35	.14	-	.14	.12	.12	.12	.12
CaCO ₃	54.61	-	-	54.50	-	-	-	-	-
CaO	-	31.4	29.45	-	29.30	30.01	29.82	29.50	29.52
CO ₂	-	46.94	46.15	-	45.90	47.01	46.74	46.22	46.27

	208	209	210	211	212
MgCO ₃	40.31	44.27	44.82	38.52	44.80
MgO	-	-	-	18.42	21.42
R ₂ O ₃ ^{a/}	.23	.29	.21	2.06	.19
SiO ₂	.09	.87	.21	6.50	1.14
CaCO ₃	59.09	54.1	53.9	-	-
CaO	-	-	-	25.72	30.01
CO ₂	-	-	-	40.35	46.90
^{a/} Fe ₂ O ₃ and Al ₂ O ₃ .					

Locations of samples in table 5

- 62 feet, West Union formation (Niagaran), Stout Run, Adams County.
- 34 feet, Peebles dolomite. Long Lick Run, 2 miles southeast of Rome, Adams County.
- 38 feet, Peebles dolomite, John Shivener quarry, Burr Run, Jefferson Township, Adams County.
- 22 feet, Henise quarry, southwest Franklin Township, Adams County.
- 14 feet, Peebles dolomite, 2-3/4 miles northwest of Byington, Pike County.
- 15 feet, Monroe formation, 1 1/4 miles west of Byington, Pike County.
- 25 feet, Cedarville dolomite, 3/4 mile west of Bainbridge, Ross County.
- 25 feet, Cedarville dolomite, 2 miles northwest of Bainbridge, Ross County.
- 42 feet, Greenfield, Ross County.
- 19 feet at bottom of quarry, Greenfield, Ross County.
- 33 feet, Lilley formation, 1 1/4 miles north of Carmel, Highland County.

Locations of samples in table 5 (Cont'd.)

12. 3 feet, Peebles formation, Carey Bros. quarry, $\frac{1}{2}$ mile south of Fallsville, Highland County.
13. 7 feet, Lilley formation, below No. 12.
14. 23 feet Peebles formation, Simpson West quarry, 1 mile north of Sinking Springs, Highland County.
15. 32 feet, Peebles dolomite, 5 miles west of Bainbridge at mouth of Plum Run, Highland County.
16. 30 feet, Cedarville formation, $1\frac{1}{4}$ miles southeast of Willettsville, Highland County.
17. Upper 8 feet in above quarry (No. 16), Ohio Asphaltic Limestone Co., Highland County.
18. 55 feet, Greenfield formation, 2 miles north of Samantha, Highland County.
- 19, 20. Greenfield, Highland County.
21. Lexington, Highland County.
22. Leesburg, Highland County.
23. Blue Rock quarry, 55-foot sample, $2\frac{3}{4}$ miles from Greenfield, Fayette County.
24. Stockpile sample of No. 23.
25. 22 feet, top of Garringer quarry, Rock Mills, $2\frac{1}{2}$ miles west of Good Hope, Fayette County.
26. 18 feet, next below No. 25.
27. Stockpile sample of Nos. 25, 26.
28. $14\frac{1}{2}$ feet, Cedarville Dolomite Products Co. quarry, Cedarville, Greene County.
29. $19\frac{1}{2}$ feet, next below No. 28.
30. $11\frac{1}{2}$ feet, Cedarville dolomite in Cedarville Gorge, Greene County.
31. $8\frac{1}{2}$ feet, next below No. 30.
32. Cedarville, Greene County.
33. Abel Magnesia Co., Cedarville, Greene County.
34. 14 feet, Niagara dolomite, Greene Co. quarry, $1\frac{3}{4}$ miles west of Jamestown, Greene County.
35. 21 feet, next below No. 34.
36. Stockpile sample of Nos. 34 and 35.
37. Yellow Spring, Greene County.
38. France Stone Co. quarry, Monroe, Greene County.
39. John Hathaway quarry, $4\frac{1}{2}$ miles west of Greenville, Darke County.
40. Greenville, Darke County.
41. New Madison, Darke County.
42. Cedarville dolomite, $1/8$ mile east of Weavers, Darke County.
43. 19-foot section, Greenville Falls, 1 mile southwest of West Covington, Miami County.
44. 11-foot section, exposure on Stillwater River near Clayton, Miami County.
45. Cold Springs, Clarke County.
46. Moores Lime Co., Cold Springs, Clarke County.
47. Moores Lime Co., Durbin, Clarke County.
48. 17-foot section, south central part of sec. 24, Mad River Township, Clarke County.
49. 9-foot section, next below No. 48.
50. Top 15 feet, Moores Lime Co., SE $\frac{1}{4}$ sec. 22, Springfield Township, Clarke County.

Locations of samples in table 5 (Cont'd.)

51. 6-foot section, next below No. 50.
52. 12-foot section, next below No. 51.
53. 26-foot section, next below No. 52.
- 54-55. Springfield, Clarke County.
56. France Stone Co. Springfield, Clarke County.
57. 26-foot section, Rockhold quarry, north of York Center, Central York Township, Union County.
58. 17-foot section, Pickring quarry, Salem Township, Champaign County.
59. Top 9 feet, McKinley and Brugler quarry, $\frac{1}{2}$ mile west of Northwood, Richland Township, Logan County.
60. 8 feet, next below No. 59.
61. 7 feet, next below No. 60.
62. Top 4 feet, Osborne quarry, $\frac{1}{4}$ mile east of Bellecenter, northeast corner of Richland Township, Logan County.
63. 25 feet, next below No. 62.
64. 10 feet, next below No. 63.
65. 5-3/4 feet at bottom, Piatt quarry, 2 miles east of West Liberty, Monroe Township, Logan County.
66. Top 14 feet of Piatt quarry (see No. 65).
67. Top 17 feet, East Liberty Stone Co. quarry $1\frac{1}{4}$ miles west of East Liberty, southwest Perry Township, Logan County.
68. 4-1/3 feet, next below No. 67.
69. $11\frac{1}{2}$ feet, next below No. 68.
70. 16-foot exposure, Cedarville dolomite, along Miami River, 1 mile northwest of Kirkwood, Orange Township, Shelby County.
71. Top 7 feet John W. Karch Stone Co. quarry, $4\frac{1}{2}$ miles southwest of Celina, Jefferson Township, Mercer County.
72. Next 18 feet below No. 71.
73. Northwest of Rockford, Mercer County.
74. Upper 7 feet, Rockford Stone Co. quarry, $1\frac{1}{2}$ miles northwest of Rockford, Mercer County.
75. Next 23 feet below No. 74.
76. Top 12 feet, Herzog Lime & Stone Co. quarry, Monroe formation, $1\frac{1}{2}$ miles southwest of Forest, Hardin County.
77. Next 56 feet below No. 76, Niagara formation.
78. Next 21 feet below No. 77, Niagara formation.
79. Herzog Lime & Stone Co. quarry, $1\frac{1}{2}$ miles southwest of Forest, Hardin County.
80. France Stone Co. quarry, Kenton, Hardin County.
81. 19 feet of Monroe dolomite, The France Stone Co. quarry, 2 miles southwest of Kenton, Hardin County.
82. Upper 9 feet, Monroe formation, Hardin Quarry Co. quarry, Blanchard, Hardin County.
83. Next 27 feet below No. 82, Monroe formation.
84. 20-foot section, Tressel Stone Works quarry, Monroe formation, $1\frac{1}{2}$ miles north of Ada, Hardin County.
85. Stockpile sample of No. 84.
86. Random sample, France Stone Co. quarry, Dunkirk, Hardin County.
87. Herzog Lime and Stone Co. quarry, near Patterson, Hardin County.
88. 17 foot quarry face, Monroe formation, Laubis Stone Co., 2 miles southwest of Marseilles, Marion County.

Locations of samples in table 5 (Cont'd.)

89. National Lime & Stone Co. quarry, Wyandot County.
90. Carey, Wyandot County.
91. Top 12 feet, National Lime & Stone Co. quarry, Monroe formation, Carey, Wyandot County.
92. Next 14 feet below No. 91, Niagara formation.
93. Next 18 feet below No. 92, Niagara formation.
94. Niagara formation, below No. 91.
95. Upper $7\frac{1}{2}$ feet, Kuenzli Quarries Co. quarry, Upper Sandusky, Wyandot County.
96. Next $10\frac{1}{2}$ feet below No. 95.
97. 24 feet of Monroe dolomite, J. L. Foucht quarry, $4\frac{1}{2}$ miles southeast of Upper Sandusky, Wyandot County.
98. 15 feet of Monroe dolomite, 3 miles southeast of Carey, Wyandot County.
- 99-101. Auglaize Stone Co. quarry, 1- $\frac{3}{4}$ miles south of Herrod, Auglaize Township, Allen County.
102. Top 16 feet American Stone Corporation quarry, sec. 29, Bath Township, Allen County.
103. Next 32 feet below No. 102.
104. Next 15 feet below No. 103.
- 105-106. Stock pile sample of No. 102.
107. 20-foot face, Watte Stone Co. quarry, $\frac{1}{4}$ mile northwest of Lafayette, Allen County.
108. Stock pile sample of No. 107.
109. Top 24 feet, Bluffton Stone Co. quarry, Bluffton, Allen County.
110. Stock pile sample of No. 109.
111. Top 21 feet, Monroe formation, Delphos Quarries Co. quarry, Delphos, Washington Township, Van Wert County.
112. Next 39 feet below No. 111.
113. The France Stone Co. quarry, Convoy, Van Wert County.
114. The France Stone Co. quarry, Middlepoint, Van Wert County.
115. Top 6 feet, France Stone Co. quarry, 1 mile west of Middlepoint, Ridge Township, Van Wert County.
116. Next $9\frac{1}{2}$ feet below No. 115.
117. Next 4 feet below No. 116.
118. Next $8\frac{1}{2}$ feet below No. 117.
119. Next 6 feet below No. 118.
120. Next 4 feet below No. 119.
121. Top 13 feet, Union Quarries Co. quarry, 8 miles northwest of Van Wert, Union Township, Van Wert County.
122. Next 12 feet below No. 121.
123. Top 7 feet, Blosser Stone Co. quarry, $2\frac{1}{2}$ miles east of Grover Hill, Washington Township, Paulding County.
124. Next $18\frac{1}{2}$ feet below No. 123.
125. Next 4 feet below No. 124.
126. Top 6 feet, National Lime & Stone Co. quarry, Rinner, Putnam County.
127. Next 29 feet below No. 126.
128. Stock pile sample of Nos. 125 and 126.
129. Top 24 feet, Schumacher Stone Co. quarry, $\frac{3}{4}$ mile south of Pandora, Putnam County.

Locations of samples in table 5 (Cont'd.)

130. Stock-pile sample of No. 129.
131. Springfield, Clark County.
132. 29-foot section, Pifer Bros. quarry, $4\frac{1}{4}$ miles north of Dunkirk, Hancock County.
133. Stock-pile sample of No. 132.
134. 28-foot face, National Lime & Stone Co. quarry, 2 miles east of Arlington, Hancock County.
135. Stock-pile sample of No. 134.
136. 37-foot face, National Lime & Stone Co. quarry, Findlay, Hancock County.
137. Stock-pile sample of No. 136.
- 138, 139. Fostoria, Seneca County.
140. Tiffin, Seneca County.
141. 15-foot section Niagara formation along Sandusky River, Tiffin, Seneca County.
142. Basic Refractories Co., Bettsville, Seneca County.
143. Top 27 feet, Monroe dolomite quarry, $\frac{1}{2}$ mile northeast of Maple Grove, Seneca County.
144. 30 feet of Niagara dolomite below No. 143.
145. Stock-pile sample, mixture of Nos. 143, 144.
146. France Stone Co. quarry, Bascom, Seneca County.
147. 30-foot quarry face, Monroe dolomite, France Stone Co. quarry, $1\frac{1}{2}$ miles east of Bascom, Seneca County.
148. Stock-pile sample of No. 147.
149. Woodworth, Sandusky County.
150. J. E. Baker Co., Fremont, Sandusky County.
151. Top 22 feet Monroe dolomite, Gottron Bros. quarry, Fremont, Sandusky County.
152. 14 feet of Monroe formation below No. 151.
153. 18 feet of Niagara formation below No. 152.
154. Samples of fines from lower part of quarry of No. 151.
155. The Dolite Co. quarry, Gibsonburg, Sandusky County.
156. Gibsonburg Lime Products Co., Gibsonburg, Sandusky County.
157. National Mortar & Supply Co., Gibsonburg, Sandusky County.
158. Kelley Island Lime & Transport Co., Gibsonburg, Sandusky County.
159. National Mortar & Supply Co., Gibsonburg, Sandusky County.
160. Stock-pile sample, 65-foot face, Niagara dolomite, Sandusky Lime Association quarry, 1 mile south of Gibsonburg, Sandusky County.
161. 44-foot section, Niagara formation, National Mortar & Supply Co. quarry, Gibsonburg, Sandusky County.
162. Stock-pile sample of No. 161.
- 163-165. Ohio Hydrate & Supply Co., Woodville, Sandusky County.
166. Woodville, Sandusky County.
167. Standard Lime & Stone Co. quarry, Woodville, Sandusky County.
168. 58-foot quarry face, Woodville Lime Products Co., $\frac{1}{2}$ mile north of Woodville, Sandusky County.
169. 14-foot section on Sandusky River, central sec. 17, Ballville Township, Sandusky County.
170. 15-foot section on Sandusky River, NE $\frac{1}{4}$ sec. 9, Ballville Township, Sandusky County.

Locations of samples in table 5 (Cont'd.)

171. 18 feet, Niagara dolomite, SE $\frac{1}{4}$ sec. 36, Perry Township, Wood County.
172. 8 feet of Niagara dolomite, 2 $\frac{1}{2}$ miles north of Fostoria, Wood County.
173. 25-foot section, Niagara dolomite, France Stone Co. quarry, $\frac{1}{2}$ mile southwest of Rising Sun, Wood County.
174. France Stone Co. quarry, Rising Sun, Wood County.
175. 64 feet Niagara dolomite, Wood County Stone & Construction Co. quarry, 2- $\frac{3}{4}$ miles south of Bowling Green, Wood County.
176. Stock-pile sample of No. 175.
177. Bowling Green, Wood Co.
178. Luckey, Wood County.
179. 69-foot section of Niagara dolomite near Luckey, Wood County.
180. Ohio Lime & Stone Co., Luckey, Wood County.
181. National Gypsum Co. quarry, Luckey, Wood County.
182. 12-foot section, basal Monroe formation, O. F. Brough quarry, $\frac{1}{2}$ mile southeast of West Millgrove, Wood County.
183. Stock-pile sample of No. 182.
184. 28 feet of Monroe formation, France Stone Co. quarry, North Baltimore, Wood County.
185. Top 3 feet, Columbus formation, Pugh Quarry Co. quarry, 3 $\frac{1}{4}$ miles northwest of Milton Center, Wood County.
186. Next 8 feet below No. 185.
187. Next 8 feet below No. 186.
188. Stock-pile sample of Nos. 185, 186, 187.
189. Sugar Ridge, Wood County.
190. The France Stone Co. quarry, Silica, Lucas County.
191. 40-foot quarry face, Monroe formation, France Stone Co. quarry, 1 mile south of Waterville, Lucas County.
192. 31-foot section, Monroe formation, France Stone Co. quarry, 1- $\frac{3}{4}$ miles north of Monclova, Lucas County.
193. 108-foot face, Lucas formation, France Stone Co. quarry, 2 $\frac{1}{2}$ miles southwest of Sylvania, Lucas County.
- 194-199. Genoa, Ottawa County.
200. U. S. Gypsum Co. quarry, Genoa, Ottawa County.
201. 80 feet Guelph member, Niagara formation, U. S. Gypsum Co. quarry, southeast of Genoa, Ottawa County.
202. Kelley Island Lime & Transport Co. quarry, Clay Center, Ottawa County.
203. Top 40 feet Niagara formation, Kelley Island Lime & Transport Co. quarry, Clay Center, Ottawa County.
204. Next 40 feet below No. 203.
205. Stock-pile sample of Nos. 203 and 204.
206. Fines of Nos. 203 and 204.
207. Fine powder of Nos. 203 and 204.
208. Quicklime, Benton Lime & Stone Co., Limestone, Ottawa County.
- 209, 210. Williston, Ottawa County.
211. 10-foot section, Monroe dolomite, SE $\frac{1}{4}$ sec. 10, Portage Township, Ottawa County.
212. 52-foot section, south shore of South Bass Island, Monroe formation, Ottawa County.

Central States West of the Mississippi River

The term "Central States," as used here, includes North and South Dakota, Minnesota, Iowa, Missouri, Kansas, Nebraska, Arkansas, Louisiana, Oklahoma, and all of Texas but the western section. No dolomite has been reported from North Dakota, Nebraska, or Louisiana, but it is known to occur in the remaining eight States.

South Dakota

The only dolomites in South Dakota outcrop in the vicinity of the Black Hills in hogbacks surrounding the mountains, except on the west side, where a wide plateau is underlain by dolomites and dolomitic limestones of the Pahasapa and Minnekahta formations. These formations are extremely variable in their magnesia content, both areally and stratigraphically. The Minnekahta limestone averages less than 40 feet in thickness and contains clay, fine sand, and varying amounts of magnesia, which in places is abundant. The Pahasapa ranges in thickness from 300 to 600 feet and is a fine-grained rock consisting principally of calcium carbonate, although in places it contains considerable magnesia. The limestones and dolomites dip away from the Black Hills at 3° to 10° . No information is available concerning possible commercial deposits of dolomite in this State. Two isolated analyses are given in table 6 (Nos. 1 and 2).

Minnesota

Carbonate rocks are confined to the southeastern part of Minnesota, and virtually all are dolomitic, some being nearly pure dolomite. Although nearly flat-lying and showing little deformation, they are more or less recrystallized. Some of them carry more than 40 percent magnesium carbonate, but many are too high in silica to be desirable for refractory purposes or magnesium-metal production. However, analyses of the Shakopee formation at Shakopee and Tawney and of the Onecta at Merriam Junction, Lanesboro, and Frontenac indicate that at these points dolomites pure enough for many uses occur. (See analyses 10, 12, 13, 20, 22, 36, 37, and 38, table 6.) In the eastern part of the limestone area the glacial-drift cover is negligible or absent, but it thickens to the west, and the best outcrops are in cliffs along streams.

In Scott County the St. Lawrence (Cambrian) limestone and the Onecta and Shakopee (Ordovician) formations are exposed. For the most part they contain a high percentage of impurities and are rather low in magnesium carbonate. Several analyses from Merriam Junction and Shakopee, however, represent high-grade material. (Nos. 3-14, table 6.)

Dolomites found in Dakota, Nicollet, and Le Sueur Counties are too impure for most uses, although some high-grade material may be found through further sampling, especially in Dakota County. Analyses 15 to 18 (table 6) are from these three counties.

Good-quality material is reported from Frontenac, Goodhue County. (See analyses 19-23, table 6.) No. 20 represents over 28 feet of low-silica, high-magnesia dolomite occurring in the Old Frontenac quarry.

The Shakopee and Oneota dolomites from Blue Earth County appear to be too high in silica to have much value. (Nos. 24-29, table 6.) The same is true of the Oneota in Winona County, although there may be high-quality material in this county not shown by the available analyses. (Nos. 30-33, table 6.)

At Spring Valley, Lanesboro, Tawney, and Rushford, Fillmore County, good-quality dolomite is reported from the Oneota, Cedar Valley, and Shakopee formations. (Nos. 34-41, table 6.)

Although detailed information on Minnesota dolomites is not available, it would appear that the best possibilities for large bodies of high-quality material are in Fillmore, Goodhue, and Scott Counties.

Iowa

Dolomites are found in three different formations of lower Paleozoic age in Iowa. The Prairie du Chien (Ordovician) dolomites outcrop in numerous places in Clayton and Allamakee Counties from the Minnesota line to Guttenberg, Iowa. The area of outcrop extends for 60 miles along the Mississippi River and for about 25 miles westward, and the beds range in thickness from 60 to almost 200 feet. Dips are very gentle, being only about 20 feet a mile to the south in these counties. The one analysis available shows a relatively high silica content, although the magnesium carbonate content is over 40 percent. (No. 55, table 6.) This sample was obtained at Girard, northeastern Clayton County. No data as to thickness or reserves of high-purity dolomite from these strata are available, although some high-grade material probably exists in them. The Prairie du Chien group includes the Shakopee and Oneota formations, which are good dolomites in places in Minnesota.

The Galena (Ordovician) dolomite outcrops intermittently for 100 miles along the Mississippi River in Allamakee, Clayton, Dubuque, and Jackson Counties and westward from the river for 25 miles. Its areal extent is very great, and the beds dip southwest at only about 20 feet a mile. The whole formation is 240 feet thick, but the middle 100 feet is somewhat cherty. The upper 100 and lower 40 feet are noncherty and dolomitic, and these beds have been quarried mainly around Dubuque. Analysis 67, table 6, is said to be representative of the noncherty part of the formation. It is not known whether analyses 61 to 64, table 6, represent the Galena or the overlying Niagara strata, but it is thought that they represent the former in Jackson and Dubuque Counties. The Galena dolomites are noted for their lateral gradation into high-calcium strata in many places in northeastern Iowa, and this fact should be kept in mind in locating quarries. It is highly probable that large bodies of high-purity dolomite are available in this formation, but until systematic sampling is done nothing definite can be said. From the analyses given, it is seen that the magnesium carbonate content is well above the required minimum, but the impurities run over 3 percent in all but one of these samples.

The Niagara (Silurian) dolomite, 340 feet thick, outcrops in Dubuque, Jackson, Clinton, Scott, Linn, Jones, Cedar, Delaware, and Fayette Counties. The strata dip 20 feet a mile to the southwest. Analyses 56 to 60, 65, and 66 (table 6) show that thicknesses up to 40 feet in this formation have a high magnesia content and are moderately low in impurities. Analyses of dolomites from Cedar, Linn, and Delaware Counties show them to be high grade and to contain low percentages of impurities. (See analyses referred to above and Nos. 46-54, table 6.) The Niagara in Cedar, Linn, and Delaware Counties offers the best possibilities for large deposits of high-grade dolomite in this State.

Missouri

Virtually the entire Ozark region is underlain by essentially flat lying dolomitic limestones and dolomites. The important magnesian formations are the Proctor, 150 feet thick and chert-free; the Eminence, 150 feet thick and somewhat cherty; the Gasconade, 200 feet thick and cherty except for the upper 50 feet; the Van Buren, 50 feet thick and somewhat cherty; and 150 feet in the Bonneterre. As yet Missouri dolomites have not been sampled and analyzed at enough points to give a true picture of their extent and purity.

Analyses 76 to 79 and 97 to 101 (table 6) show the high quality of the Proctor dolomite in Morgan and Camden Counties. These analyses show less than 2 percent impurities, and all of them have a magnesium carbonate content of more than 42 percent. The thickness of the Proctor represented by these analyses, is about 30 feet out of the total of 150 feet.

The Gasconade and Jefferson City formations in Phelps and Texas Counties are generally cherty and contain less than 40 percent magnesium carbonate.

Analyses from Shannon County show that the Eminence formation approaches nearly the theoretical composition of pure dolomite. (Nos. 92-94, table 6.) The next two analyses, also from this county, indicate that the Van Buren and Gasconade are too high in impurities to be of much value.

Again, in Washington County the Eminence formation is quite pure. The thickness represented by analyses 84 to 87, 90, and 91 (table 6) is about 30 feet. Thus, it seems possible that large reserves of high-purity material may be present in this county.

The Bonneterre formation in Madison County is represented by analyses 102 to 108 (table 6), which are from a 150-foot section. Several of these analyses indicate a moderately good grade dolomite, and it is probable that sizable reserves are available.

Isolated analyses (Nos. 74 and 75, table 6) from Iron and McDonald Counties, respectively, indicate the possible occurrence of commercial dolomite, but impurities are high, and the extent of the deposits is unknown.

Kansas

Dolomites in Kansas are found in the Day Creek dolomite in Clark and Comanche Counties, southwestern Kansas, and the Stone Corral dolomite in Rice, Reno, and Sedgewick Counties, south-central Kansas. These beds are essentially flat lying and range in thickness from less than 2 to slightly more than 10 feet. Available analyses show that the magnesium carbonate content generally does not exceed 37 percent and that impurities constitute more than 4 percent.

Arkansas

Little information is available concerning Arkansas dolomites, although magnesian limestones are known to occur in the Cambro-Ordovician strata of the northern and northeastern parts of the State in Benton, Carroll, Searcy, Clark, and Marion Counties. The four available analyses indicate impure dolomite. (See Nos. 110-113, table 6.)

Oklahoma

Large reserves of dolomite are available in the Arbuckle Mountain area, the Wichita Mountain area, and northeastern Oklahoma in the Cambro-Ordovician Arbuckle group of rocks and their partial equivalent, the Cotter dolomite. The lower 2,250 feet of the Arbuckle group is predominantly magnesian, and in more than 1,500 feet of this thickness the CaO:MgO ratio is very near that of true dolomite. Although much of it is contaminated with silica, alumina, and iron oxide, nevertheless important deposits of high-grade dolomite are available. Western Oklahoma also has some dolomite in the Permian formations, although it rarely approaches the thickness or purity of the Arbuckle dolomites.

Arbuckle Mountain area. - Ten miles south of Davis, in Murray County, a measured stratigraphic section containing more than 1,500 feet of dolomites is exposed over a distance of several miles. Individual beds are as much as 400 feet thick, and as they dip south 45° to 50° the outcrop is fairly wide. Analyses from Murray County given in table 6 (Nos. 114-116) indicate the quality of the material. Reserves have not been estimated but are probably of the order of many millions of tons. Southwest of Mill Creek, in Johnston County, the Royer dolomite of the Arbuckle group outcrops over a large area and dips about 15° westward. Several analyses (Nos. 117-120, table 6) but no figures for tonnage or thickness are available. Dolomites are also found north of Mill Creek. The deposits in the Arbuckle Mountains are more extensive than indicated here but have not been studied in detail. They are readily available to railroad transportation and fuels, particularly in Johnston County.

Wichita Mountain area. - Dolomites in this area have been studied in two localities - near Lawton, Comanche County, and in southeastern Kiowa County. A few miles northwest of Lawton several million tons of heavy-bedded, high-grade dolomites, representing the Strange formation^{9/} of the Arbuckle group, are available. They are 80 feet thick, dip 12° to 15° southwest, and are very

^{9/} Decker, C. E., Timbered Hills and Arbuckle Groups: Oklahoma Geol. Surv. Circ. 22, 1939, p. 24.

pure. (See Nos. 121-128, table 6.) Fairly high grade material is known in southeastern Kiowa County 9 miles south of Gotebo. (Nos. 129-134, table 6.) A thickness of at least 80 feet of dolomite is available, and the dips in the area range from 18° to 25° northward. Reserves are said to be large, and the deposit is accessible to roads.

The extent of the deposits in the Wichita Mountains is believed to be considerably greater than in the areas described above, but others have not been studied in sufficient detail to warrant discussion. Oil and gas are available nearby, and present roads are adequate for development.

Other areas. - Delaware County in northeastern Oklahoma contains dolomite, although available analyses indicate that its silica content is high. (Nos. 135-137, table 6.) Thicknesses and reserves are unknown, and the rock is not readily accessible.

Thin beds of Permian dolomite outcrop over large areas in western Oklahoma but have doubtful commercial value. Thicknesses greater than 5 feet are rare, and impurities generally exceed 2 percent. (See Nos. 138-145, table 6.)

Texas

Available information is incomplete at present, but a survey by the Texas Bureau of Economic Geology (personal communication, April 1942) is in progress to supplement the present data. Dolomite is found in pre-Cambrian and lower Paleozoic formations in Llano and Burnet Counties. Details are lacking, but large deposits are reported to be available. Analyses 150 and 151 (table 6) are from Burnet County, but they may not be representative of dolomites in the Llano region as a whole. Ten feet of dolomite in Potter County, northern Texas, is represented by analyses 146 to 149 (table 6). Permian and Cretaceous dolomites are said to occur widely through west-central and central Texas. (See, also, discussion of western Texas in section on the Western States.)

TABLE 6. - Analyses of dolomites from the Central States

	1	2	3	4	5	6	7	8	9
MgCO ₃	-	-	40.81	43.7	38.8	40.0	40.4	43.7	39.4
MgO	19.85	19.7	-	-	-	-	-	-	-
R ₂ O ₃ ^{a/}	.36	.7	-	1.30	2.30	2.70	1.40	2.6	1.3
SiO ₂	1.12	.5	7.76	2.20	3.70	3.70	6.60	3.4	4.3
CaCO ₃	-	-	50.66	53.6	53.0	53.4	51.6	54.2	53.4
CaO	21.51	32.3	-	-	-	-	-	-	-
CO ₂	45.66	46.8	-	-	-	-	-	-	-
^{a/} Fe ₂ O ₃ and Al ₂ O ₃ .									

TABLE 6. - Analyses of dolomites from the Central States (Cont'd.)

	10	11	12	13	14	15	16	17	18
MgCO ₃	40.0	40.2	43.1	44.3	41.55	40.02	40.50	39.83	40.06
R ₂ O ^{a/} ₃	.3	1.8	1.3	.6	-	-	2.5	-	-
SiO ₂	1.7	6.9	1.5	1.3	9.08	3.26	4.6	11.55	8.99
CaCO ₃	53.9	51.1	54.6	54.6	49.70	56.82	52.60	48.49	51.02

	19	20	21	22	23	24	25	26	27
MgCO ₃	41.11	43.5	39.3	44.5	43.5	41.4	39.5	38.5	38.5
R ₂ O ^{a/} ₃	-	1.0	1.3	.5	.5	1.1	1.1	1.3	1.2
SiO ₂	8.48	1.3	8.8	1.1	3.7	3.1	10.4	12.4	10.6
CaCO ₃	46.74	54.5	51.4	54.1	52.6	55.0	48.9	47.3	49.1

	28	29	30	31	32	33	34	35	36
MgCO ₃	39.6	39.6	41.96	44.0	43.1	41.2	43.58	43.5	40.8
R ₂ O ^{a/} ₃	1.3	1.0	-	.7	.4	.6	-	.2	.4
SiO ₂	9.2	9.8	7.53	3.1	4.1	3.2	2.02	4.1	1.2
CaCO ₃	49.3	49.3	49.59	52.8	52.5	55.0	54.48	53.0	57.8

	37	38	39	40	41	42	43	44	45
MgCO ₃	43.7	41.8	39.9	39.1	39.7	42.06	42.53	41.33	-
MgO	-	-	-	-	-	-	-	-	19.6
R ₂ O ^{a/} ₃	.3	.2	.3	.4	.5	.70	.67	.96	.4
SiO ₂	2.1	1.0	4.1	2.8	3.8	3.45	2.93	6.32	1.5
CaCO ₃	54.0	57.1	56.1	57.5	56.2	49.66	54.78	51.23	-
CaO	-	-	-	-	-	-	-	-	29.2

a/ Fe₂O₃ and Al₂O₃.

TABLE 6. - Analyses of dolomites from the Central States (Cont'd.)

	46	47	48	49	50	51	52	53	54
MgCO ₃	44.96	43.04	42.58	39.5	42.6	44.73	43.89	43.0	43.85
R ₂ O ₃ ^{a/}	.59	.57	.90	.9	.7	.61	.52	1.4	.26
SiO ₂	.83	1.29	.90	1.2	.4	.29	1.98	.6	.12
CaCO ₃	53.62	55.17	55.61	58.2	56.4	54.62	53.64	55.3	55.76

	55	56	57	58	59	60	61	62	63
MgCO ₃	40.09	42.66	41.58	43.94	41.21	41.55	41.78	43.57	42.12
R ₂ O ₃ ^{a/}	b/5.03	b/2.10	b/4.28	b/1.85	b/1.06	b/1.54	b/1.90	b/3.61	b/4.10
CaCO ₃	54.88	55.24	54.14	54.21	57.73	56.91	56.32	52.82	53.78

	64	65	66	67	68	69	70	71	72
MgCO ₃	43.32	40.81	40.69	41.79	41.51	43.41	40.66	40.83	41.66
R ₂ O ₃ ^{a/}	-	-	-	.82	.53	.48	.83	1.03	.74
SiO ₂	b/10.54	b/3.13	b/4.59	2.15	.42	1.53	5.39	1.51	1.92
CaCO ₃	46.16	56.06	54.72	54.84	57.54	54.32	53.18	56.68	55.56

	73	74	75	76	77	78	79	80	81
MgCO ₃	44.64	42.59	43.02	43.80	44.30	43.13	43.80	41.30	41.78
R ₂ O ₃ ^{a/}	.85	2.75	.68	.35	.32	.47	.32	-	2.51
SiO ₂	.80	1.86	5.98	1.18	.76	.66	.88	.44	2.48
CaCO ₃	53.62	52.85	50.50	54.68	54.68	55.47	55.86	56.19	52.07

	82	83	84	85	86	87	88	89	90
MgCO ₃	40.37	41.06	45.46	46.05	46.01	46.30	42.87	41.13	40.77
R ₂ O ₃ ^{a/}	4.29	4.05	.36	.35	1.06	.57	.66	.64	.28
SiO ₂	2.60	7.50	1.35	.40	.22	.28	5.55	1.00	.89
CaCO ₃	50.06	47.17	52.19	52.51	53.40	53.07	49.62	57.18	57.78

a/ Fe₂O₃ and Al₂O₃. b/ Impurities.

TABLE 6. - Analyses of dolomites from the Central States (Cont'd.)

	91	92	93	94	95	96	97	98	99
MgCO ₃	41.63	45.62	45.73	46.85	42.04	43.42	43.47	45.80	43.40
R ₂ O ₃ ^{a/}	.52	.95	.80	.45	3.17	1.96	.89	.55	.58
SiO ₂	1.25	.70	.48	.13	6.58	4.78	.68	.52	1.14
CaCO ₃	55.63	52.73	52.75	52.51	47.62	50.29	54.77	55.04	54.95

	100	101	102	103	104	105	106	107	108
MgCO ₃	43.76	43.91	39.41	42.30	41.62	42.59	42.99	43.17	43.45
R ₂ O ₃ ^{a/}	.50	.61	4.30	1.32	1.89	1.64	.90	.84	1.38
SiO ₂	.90	.60	.36	.46	.30	.88	.48	.32	1.20
CaCO ₃	54.77	54.77	55.25	55.43	55.34	55.25	55.25	55.25	53.47

	109	110	111	112	113	114	115	116	117
MgCO ₃	40.51	39.23	40.0	40.85	42.32	37.60	43.15	43.35	44.67
R ₂ O ₃ ^{a/}	1.59	4.72	-	-	3.02	1.15	.70	.76	1.48
SiO ₂	6.75	8.65	-	-	3.19	9.02	1.24	.38	1.02
CaCO ₃	51.05	47.91	49.53	49.75	50.04	53.00	55.05	55.48	52.04

	118	119	120	121	122	123	124	125	126
MgCO ₃	41.83	41.91	38.98	42.79	43.16	43.21	42.96	44.29	44.71
R ₂ O ₃ ^{a/}	1.08	1.96	2.26	.94	.82	1.00	.58	.49	.63
SiO ₂	1.06	1.90	.56	1.48	.70	.58	1.20	.68	.98
CaCO ₃	56.20	54.34	57.82	53.86	55.64	54.61	55.50	55.29	54.77

	127	128	129	130	131	132	133	134	135
MgCO ₃	44.34	45.51	43.20	42.00	41.40	41.15	42.40	38.05	41.74
R ₂ O ₃ ^{a/}	.58	.61	.54	1.01	.70	.71	.90	.52	1.13
SiO ₂	1.22	.58	.72	1.68	5.60	.72	1.83	4.28	7.48
CaCO ₃	54.59	54.93	55.20	56.51	52.88	55.48	54.65	55.95	51.57

a/ Fe₂O₃ and Al₂O₃.

TABLE 6. - Analyses of dolomites from the Central States (Cont'd.)

	136	137	138	139	140	141	142	143	144
MgCO ₃	42.66	42.85	40.36	41.53	41.20	40.61	38.27	41.83	40.36
Fe ₂ O ₃ ^{a/}	1.10	.68	4.06	1.86	3.78	.70	1.77	1.50	1.80
SiO ₂	4.80	5.98	4.00	3.40	4.18	1.44	3.70	6.62	7.00
CaCO ₃	52.29	51.40	52.04	53.61	50.36	55.66	56.88	51.18	52.43

	145	146	147	148	149	150	151
MgCO ₃	39.23	-	-	-	-	-	-
MgO	-	20.54	20.57	20.23	20.02	19.83	18.71
Fe ₂ O ₃ ^{a/}	2.24	1.89	1.30	1.07	2.30	.91	1.51
SiO ₂	6.64	1.95	1.70	3.76	2.55	1.18	.56
CaCO ₃	53.18	-	-	-	-	-	-
CaO	-	30.40	28.34	29.64	29.66	-	-

a/ Fe₂O₃ and Al₂O₃.Locations of samples in table 6

1. Minnekahta limestone, near Hot Springs, Fall River County, Black Hills, S. Dak.
2. Dolomite, Black Hills, S. Dak.
3. St. Lawrence limestone, St. Lawrence, Scott County, Minn.
- 4-9. 40-foot section of Oneota, Joseph Lindhoff quarry, Merriam Junction, Scott County, Minn.
10. Railroad cut, Oneota dolomite, Merriam Junction, Scott County, Minn.
- 11-13. Shakopee dolomite, J. B. Center quarry, Shakopee, Scott County, Minn.
14. St. Lawrence limestone, St. Lawrence, Scott County, Minn.
15. Oneota dolomite, Hastings, Dakota County, Minn.
16. St. Lawrence limestone, Judson, Nicollet County, Minn.
- 17-18. 20-foot section, Breen quarry, Kasota, Le Sueur County, Minn.
19. Shakopee dolomite, Cannon Falls, Goodhue County, Minn.
- 20-23. 44-foot section, Oneota dolomite, Old Frontenac quarry, Frontenac, Goodhue County, Minn.
24. 8-foot section, Shakopee dolomite, Fowler and Pay quarry, Mankato, Blue Earth County, Minn.
- 25-29. 20-foot section, Oneota dolomite, Pilgrim's Rest Cemetery, Mankato, Blue Earth County, Minn.
30. Lower part of Oneota dolomite, near Winona, Winona County, Minn.
- 31-33. Oneota dolomite, Winona County, Minn.
34. Cedar Valley limestone, Spring Valley, Fillmore County, Minn.

Locations of samples in table 6 (Cont'd.)

35. Oneota dolomite, Lanesboro, Fillmore County, Minn.
36. Shakopee dolomite, Tawney, Fillmore County, Minn.
37. Shakopee dolomite, Lanesboro, Fillmore County, Minn.
- 38-39. Oneota dolomite, Lanesboro, Fillmore County, Minn.
40. Oneota dolomite, Rushford, Fillmore County, Minn.
41. Oneota dolomite, Prebble Township, Fillmore County, Minn.
42. Lanesboro, Fillmore County, Minn.
43. Frontenac, Goodhue County, Minn.
44. Winona, Winona County, Minn.
45. Dubuque Stone Products Co., Dubuque, Dubuque County, Iowa.
46. Niagara formation, eastern Iowa.
47. Niagara formation, Mt. Vernon, Linn County, Iowa.
48. Niagara formation, Bertram, Linn County, Iowa.
49. Coggon beds, Bieler's quarry, Cedar County, Iowa.
50. Gower stage, Bieler's quarry, Cedar County, Iowa.
51. Gower stage, Mt. Vernon quarry, Linn County, Iowa.
52. On Cedar River, 6 miles from Mt. Vernon, Linn County, Iowa.
53. Lime City, Cedar County, Iowa.
54. Gower limestone, $2\frac{1}{2}$ miles southwest of Tipton, Cedar County, Iowa.
55. 12-foot face, NW $\frac{1}{4}$ sec. 21, Girard Township, Clayton County, Iowa.
56. 20-foot face, SW $\frac{1}{4}$ sec. 15, Sugar Creek, Cedar County, Iowa.
57. 12-foot face, SW $\frac{1}{4}$ sec. 27, Waterford, Clinton County, Iowa.
58. 10-foot face, sec. 35, Delaware, Delaware County, Iowa.
59. 7-foot face, NW $\frac{1}{4}$ sec. 25, Bremen, Delaware County, Iowa.
60. 8-foot face, NW $\frac{1}{4}$ sec. 36, Oneida, Delaware County, Iowa.
61. 40-foot face, NW $\frac{1}{4}$ sec. 23, South Fork, Jackson County, Iowa.
62. 25-foot face, NE $\frac{1}{4}$ sec. 10, Vernon, Dubuque County, Iowa.
63. 14-foot face, NW $\frac{1}{4}$ sec. 11, Taylor, Dubuque County, Iowa.
64. 25-foot face, SE $\frac{1}{4}$ sec. 7, N. Dubuque, Dubuque County, Iowa.
65. 50-foot face, NE $\frac{1}{4}$ sec. 6, Fairview, Jones County, Iowa.
66. 40-foot face, SW $\frac{1}{4}$ sec. 5, Fairview, Jones County, Iowa.
67. Galena dolomite, random sample along Mississippi River, Iowa.
68. Monmouth, Jackson County, Iowa.
69. Niagara formation, sec. 36, Douglas Township, Bremer County, Iowa.
70. Galena horizon, Dubuque County, Iowa.
71. J. A. Green quarry, Stone City, Jones County, Iowa (average of 9 analyses)
72. Dearborn and Sons quarry, Stone City, Jones County, Iowa (average of 5 analyses).
73. South of Irondale, Washington County, Mo.
74. Iron County, Mo.
75. Southwest City, McDonald County, Mo.
- 76-79. NE $\frac{1}{4}$ sec. 8, T. 40 W., R. 18 W., Coffman's Camp, Morgan County, Mo.
80. Gasconado formation, 5-foot drill cuttings 305 to 310-foot depth, Rolla, Phelps County, Mo.
81. SW $\frac{1}{4}$ sec. 25, T. 36 N., R. 2 E., Washington County, Mo.
82. Bonnetterre, 40 feet above base, SE $\frac{1}{4}$ sec. 13, T. 35 N., R. 2 E., Washington County, Mo.
83. Derby dolomite, SW $\frac{1}{4}$ sec. 8, T. 35 N., R. 2 E., Washington County, Mo.

Locations of samples in table 6 (Cont'd.)

84. 150 feet below top of Potosi, SW $\frac{1}{4}$ sec. 13, T. 38 N., R. 1 E., Washington County, Mo.
85. Near top of Potosi, NW $\frac{1}{4}$ sec. 3, T. 37 N., R. 1 E., Washington County, Mo.
86. 40 feet above base of Eminence, SW $\frac{1}{4}$ sec. 33, T. 38 N., R. 1 E., Washington County, Mo.
87. Near top of Eminence, SW $\frac{1}{4}$ sec. 35, T. 38 N., R. 1 E., Washington County, Mo.
88. Basal Van Buren, NE $\frac{1}{4}$ sec. 23, T. 37 N., R. 1 E., Washington County, Mo.
89. Gasconade, 15 ft. below Roubidoux contact, SW $\frac{1}{4}$ sec. 21, T. 37 N., R. 1 E., Washington County, Mo.
90. Eminence dolomite, upper ledge, 2 miles west of Potosi, Washington County, Mo.
91. Eminence dolomite, lower ledge, 2 miles west of Potosi, Washington County, Mo.
92. Eminence dolomite, SW $\frac{1}{4}$ sec. 26, T. 29 N., R. 4 W., Shannon County, Mo.
93. Eminence dolomite, NW $\frac{1}{4}$ sec. 18, T. 28 N., R. 3 W., Shannon County, Mo.
94. Eminence dolomite, sec. 20, T. 30 N., R. 4 W., Shannon County, Mo.
95. Van Buren dolomite, sec. 14, T. 29 N., R. 4 W., Shannon County, Mo.
96. Gasconade dolomite, sec. 16, T. 30 N., R. 4 W., Shannon County, Mo.
- 97-101. Proctor dolomite, sec. 27, T. 38 N., R. 17 W., Camden County, Mo.
- 102-108. Bonnetterre dolomite, 150 foot section, Madison County, Mo.
109. Marion, Marion County, Kans.
- 110,111. Leatherwood Switch, Clark County, Ark.
112. Waldous, Clark County, Ark.
113. Wood's Mine, Marion County, Ark.
- 114,115. Butterly dolomite, sec. 18, T. 2 S., R. 2 E., south of Davis, Murray County, Okla.
116. Royer dolomite, sec. 7, T. 2 S., R. 2 E., south of Davis, Murray County, Okla.
117. Royer dolomite, sec. 27, T. 2 S., R. 4 E., southwest of Millcreek, Johnston County, Okla.
- 118,119. Royer dolomite, sec. 26, T. 2 S., R. 4 E., southwest of Millcreek, Johnston County, Okla.
120. Royer dolomite, sec. 27, T. 2 S., R. 4 E., southwest of Millcreek, Johnston County, Okla.
121. Strange formation, sec. 8, T. 2 N., R. 12 W., northwest of Lawton, Comanche County, Okla.
- 122,123. Strange formation, sec. 20, T. 2 N., R. 12 W., northwest of Lawton, Comanche County, Okla.
124. Strange formation, sec. 9, T. 2 N., R. 12 W., northwest of Lawton, Comanche County, Okla.
- 125,126. Strange formation, sec. 20, T. 2 N., R. 12 W., northwest of Lawton, Comanche County, Okla.
127. Strange formation, sec. 9, T. 2 N., R. 12 W., northwest of Lawton, Comanche County, Okla.
128. Strange formation, sec. 8, T. 2 N., R. 12 W., northwest of Lawton, Comanche County, Okla.
129. Kindblade formation, sec. 35, T. 6 N., R. 16 W., southeastern Kiowa County, Okla.

Locations of samples in table 6 (Cont'd.)

- 130. Kindblade formation, sec. 31, T. 6 N., R. 15 W., southeastern Kiowa County, Okla.
- 131. Kindblade formation, sec. 36, T. 6 N., R. 16 W., southeastern Kiowa County, Okla.
- 132. Royer dolomite, sec. 26, T. 6 N., R. 14 W., southeastern Kiowa County, Okla.
- 133. Royer dolomite, sec. 16, T. 6 N., R. 14 W., southeastern Kiowa County, Okla.
- 134. Kindblade formation, sec. 36, T. 6 N., R. 16 W., southeastern Kiowa County, Okla.
- 135. Cotter dolomite, sec. 23, T. 20 N., R. 24 E., Delaware County, Okla.
- 136. Cotter dolomite, sec. 34, T. 22 N., R. 23 E., Delaware County, Okla.
- 137. Cotter dolomite, sec. 17, T. 23 N., R. 25 E., Delaware County, Okla.
- 138-140. Blaine formation, sec. 19, T. 16 N., R. 10 W., Blaine County, Okla.
- 141. Relay Creek formation, sec. 31, T. 15 N., R. 11 W., Blaine County, Okla.
- 142. Creta formation, sec. 13, T. 2 N., R. 22 W., Jackson County, Okla.
- 143. Creta formation, sec. 27, T. 1 N., R. 23 W., Jackson County, Okla.
- 144. Creta formation, sec. 34, T. 1 N., R. 23 W., Jackson County, Okla.
- 145. Creta formation, sec. 16, T. 2 S., R. 23 W., Jackson County, Okla.
- 146-149. Potter County, Texas.
- 150-151. Reed Yett's place, 5 miles northeast of Fairland, Burnet County, Tex.

Western States

The most-important and best-known deposits of dolomite in the Western States occur in California, Nevada, and Arizona. Little is known regarding occurrences in Utah, Washington, Wyoming, western Texas, and southeastern New Mexico, although high-grade material is found in several localities. No deposits of possible commercial interest are reported from Montana, Idaho, Oregon, or Colorado.

California

The commercial production comes from quarries in Inyo, San Benito, San Bernardino, Monterey, and Tuolumne Counties. Occurrences have been noted in Santa Clara, Calaveras, Nevada, Los Angeles, and San Diego Counties.

The principal mountain ranges east of the Sierra Nevada in Inyo County are composed in places of dolomitic limestones and dolomites. The deposits being worked are on the western and southwestern flanks of the Inyo Mountains just east of Owens Lake and near Keeler, east of Dolomite Siding, near Cartago, and in the vicinity of Swansca station. The strata are folded and fractured to some extent. No information is available as to dips of beds, total tonnages, or thickness of deposits. Farther north in the Inyo Range large quantities are reported at Marble Canyon, Antelope Creek, and Wyman Creek in the northeast corner of the Bishop quadrangle. The steeply dipping Reed dolomite, 2,000 feet thick, is the important formation in this area, but no data are available as to how much of it can be classed as high grade. Analyses from Inyo County are given in table 7, Nos. 6 to 8, 10, and 12 to 20. Analysis 7 represents a reportedly large deposit near Zurich, 20 miles southeast of Bishop.

In San Benito County high-quality dolomite is being quarried for basic refractories near Hollister and in the Cienega district to the southwest. In several localities outcrops of virtually pure, white, crystalline dolomite are 200 to 300 feet wide, and the overburden is usually light. (See analyses 1 to 5, table 7.)

Excellent material is reported near Amboy, Keenbrook, Hinkley, and 15 miles northeast of Arroyo Grande, San Bernardino County. It forms low hills rising 50 to 100 feet above the valley floor near Amboy. The deposit near Hinkley is estimated to contain 25,000,000 tons of commercial rock. Northeast of Arroyo Grande the dolomite is high grade, but it is accessible only by trail. (See analysis 11, table 7.)

At Natividad. Monterey County, large bodies of high-grade material have been developed, but further information is unavailable.

High-quality, low-silica dolomite is reported from a large deposit at Sonora, Tuolumne County, but analyses and data on reserves are lacking.

In Los Angeles County dolomite occurs on the west slope of the San Gabriel Mountains in secs. 13 and 17, R. 15 W., T. 3 N., and in secs. 7 and 18, R. 14 W., T. 3 N., between Pacoima and Grapevine Canyons north of San Fernando. At the Baughman deposit, 5 miles north of San Fernando, a north-dipping belt of white, crystalline dolomite 300 feet wide and 3,000 feet long occurs as a lens in granite. The Ramelli deposit, on the west slope of the San Gabriel Mountains 4 miles northeast of San Fernando, has an exposure of white, crystalline material dipping northward 200 to 500 feet wide and at least 3,000 feet long.

A deposit at Live Oak Spring, southeastern San Diego County, is said to contain over 100,000,000 tons of high-grade, coarsely crystalline white and gray dolomite. Analysis 9, table 7, is representative of the material.

No information is available on occurrences in Santa Clara, Calaveras, and Nevada Counties.

Nevada

An unusually interesting deposit occurs in Clark County as a detached mountain rising about 1,000 feet above the surrounding country and covering an area of approximately 1,000 acres. The strata are essentially flat lying and consist of an upper dolomite layer 700 feet thick, a middle 180-foot layer of nearly pure high-calcium limestone, and a lower layer of undetermined thickness consisting of high-grade dolomite. Together, the two dolomite layers constitute at least 80 percent of the mountain, and both consist of high-purity material. The magnesian rock is massive and remarkably uniform both laterally and stratigraphically, and no faults or structural irregularities are present to confuse quarrying operations. At least 300,000,000 tons are reported to be readily available. An average analysis (No. 21, table 7) indicates the high quality of the material. The amount of impurities throughout the deposit is said to vary not more than 10 percent of the figures shown.

At Goodsprings, also in Clark County, dolomite is reported by Hewett,^{10/} and the analyses given by him show that some of the material is of high grade. (See Nos. 113-126, table 7.)

Dolomite occurs in the Cambrian formations in the Silverpeak district but is inaccessible to economical transportation. Much of it is too high in iron and silica to be of value, although in the total thickness of nearly 1,000 feet of magnesian rock that dips away from the Silverpeak Range there may be some good-quality material. Analyses 23 and 24 (table 7) are from this area.

Dolomite is said to be present in great abundance over the section of Nevada bounded by Eureka, Pioche, and the Colorado River, but, owing to the fact that Nevada geology is incompletely mapped, not much can be said concerning large areas. However, information is available indicating that high-grade material may occur in the Pioche and Eureka districts. (See analyses 25-30, table 7.)

Arizona

Field work in favorable areas indicates that large tonnages of high-grade dolomite are present in this State^{11/}. The most promising areas appear to be northwestern Arizona, where railway, highway, or water transportation and Colorado River power are available; and central Arizona, accessible to the power and transportation facilities of the Salt River Valley. Determination of actual tonnages available in the various districts awaits more detailed field work. Several of the analyses (Nos. 31-47, table 7) are incomplete, but they show that material of usable quality probably is available.

In northwestern Arizona, deposits in the Lake Mead area in Mohave County are favorably situated because of the electric power that might be available from Boulder Dam and possible water transportation on Lake Mead to Boulder City connecting with a branch of the Union Pacific Railway. The most accessible deposits are those on Tassai Ridge below Pierce Ferry, 78 miles by road from Kingman and 40 airline miles from Boulder Dam. The western slope of the ridge above Lake Mead contains at least 750 feet of dolomite, dipping southeast at 20° to 65° and extending several miles along the lake. A large tonnage may be available here. (See analyses 37-41, table 7.) The Peach Springs area, on the eastern edge of the county, contains large amounts of dolomite in essentially flat lying beds, which occur in low ridges extending about 1½ miles along the Santa Fe tracks. The overburden is not excessive, and the reserve tonnage is large.

The same geologic horizons cover large areas south and southwest of Seligman in northwestern Yavapai County. Beds up to 80 feet thick, outcropping with a nearly flat dip in the lower slopes of hills, have a high magnesia content.

10/ Hewett, D. F., Geology and Ore Deposits of the Goodsprings Quadrangle, Nevada: Geol. Surv. Prof. Paper 162, 1931, 172 pp.

11/ Wilson, E. D., Dolomite in Arizona: Arizona Bureau of Mines, Unpublished Report, April 1942.

(See analysis 45, table 7.) In the upper Chino Valley, about 9 miles north of Del Rio, an extensive area of horizontal Devonian limestone outcrops in low, rolling hills without much overburden. The only sample available (analysis 46, table 7) shows that the magnesia content is slightly less than that accepted as a minimum for high-purity dolomite, but further work in the area may show higher-grade material in more limited areas. Analyses 31, 32, 33, and 36 (table 7) are of dolomites in the Grand Canyon area west of El Tovar.

Dolomite has recently been found in the Agua Fria-Humburg district in central Arizona, 38 miles north of Marinette, Maricopa County. The strata dip gently and cover large areas; one persistent 25-foot bed shows a moderately high magnesia content. (See analysis 47, table 7.) A deposit containing a large tonnage also occurs east of Agua Fria near Castle Hot Springs (see analysis 35, table 7). In certain of the mountain ranges in the central and southern parts of the State the Martin limestone approaches high-purity dolomite (see analysis 34, table 7).

Utah

Little is known regarding dolomite in this State, although five analyses are available. A deposit of high-quality dolomite, said to be of large size, occurs near Grantsville, south of Great Salt Lake, in Tooele County (see analysis 73, table 7), but there is no information concerning the extent or thickness of this body. There is large occurrence in Green Canyon 5 miles northeast of Logan, Cache County, but no analysis or other information is available. Several analyses from the Park City district and the San Francisco district in Summit County are given in table 7. (Nos. 74-77.)

Washington

Dolomite is found in Ferry and Stevens Counties. The Ferry County occurrences are small and discontinuous, offering little possibility for large operations. The only analysis given is of a coarsely crystalline, white dolomite near Orient. (No. 62, table 7.)

A number of analyses from Chewelah, Colville, and Addy, Stevens County, are shown in table 7. (Nos. 63-68.) In this area the limestones and dolomites have been intruded by granite and metamorphosed so that for the most part they are coarsely crystalline. The dolomite generally occurs as lenses in the granite and gneiss and has a varying dip. Stevens County is the most promising source of commercial deposits in the State.

Wyoming

Pre-Cambrian dolomites occur in a number of places in Wyoming as roof pendants in granite. These dolomites are generally coarsely crystalline, and although some of them are very pure, many others are quite impure, carrying diopside, tremolite, antigorite, and silica in large amounts. Their composition commonly varies greatly over short distances. The main known occurrences are (1) in the Medicine Bow Range, (2) the Laramie Range, (3) the Whalen group near

Guernsey, and (4) the Sierra Madre. More than 20 percent magnesia has been reported in dolomite from Platte and Albany Counties in the Laramie Mountains. A large deposit is said to occur near Wheatland, although available analyses show that it has a high silica content.

The Bighorn (Ordovician) is the thickest dolomitic formation in the State. It is massive, dense, and light-colored and ranges in thickness from 150 to 300 or more feet. It outcrops in many places in the eastern part of Wyoming, the more important areas being the Big Horn Mountains, Wind River Canyon, Owl Creek Mountains, and the Wind River Mountains. The Bighorn formation retains a similar lithology throughout its areal extent, and the analyses (table 7, Nos. 92-112) suggest that it may have a high magnesia content wherever it outcrops. Analyses from Cody and the Wind River Canyon not included in table 7 show more than 21 percent magnesia.

Dolomites may also occur in the Madison, Jefferson, Minnekahta, and other formations; but before any definite statement is made regarding this, an exploration and sampling program will have to be carried out.

New Mexico and Western Texas

Fairly high-grade dolomite is found in the area near Carlsbad, Eddy County, in southeastern New Mexico and in Culberson County, Tex. There may also be some high-grade material in the El Paso-Las Cruces region, but no analyses showing a high enough magnesia content have been reported. Eighteen miles northwest of Carlsbad a 15-foot exposure of high-grade Permian dolomite at the top of a cliff is essentially flat-lying and may cover a wide area. At another locality nearer Carlsbad a 7-foot bed of dolomite is rather high in impurities but may grade into purer material laterally. Analyses 49 to 56 (table 7) are from the Carlsbad area.

Permian dolomites are known in western Texas, but little information concerning them is available. One analysis (No. 48, table 7) from Culberson County represents dolomite from El Capitan in the Guadalupe Mountains. It appears to be fairly high grade, but the thickness and area represented are not known.

Oregon

The analysis of a dolomite from the Wallowa Mountains in northeastern Oregon, given in table 7 (No. 69), is the only record of the occurrence of acceptable material in the State. No further information concerning it is available.

Montana

No information concerning dolomite in Montana is recorded, aside from three scattered analyses (Nos. 70-72, table 7) from Lewis and Clark and Big Horn Counties. The analyses represent material of sufficient purity to justify further investigation.

Colorado

Analyses 78 to 91 in table 7 are from this State. Although some of them represent high-quality material, nothing is known regarding the size of deposits or their commercial possibilities. Occurrences are reported from Lake, Park, Pitkin, and Summit Counties.

TABLE 7. Analyses of dolomites from the Western States

	1	2	3	4	5	6	7	8	9
MgCO ₃	-	47.02	43.82	47.30	46.08	40.50	46.90	44.45	-
MgO	21.23	-	-	-	-	-	-	-	20.89
R ₂ O ₃ ^{a/}	.47	.14	.30	.13	.11	.55	.72	b/.60	.35
SiO ₂	.17	1.08	2.28	.42	.14	.30	.25	-	.43
CaCO ₃	-	51.75	53.60	51.90	53.65	59.40	52.13	54.25	-
CaO	31.00	-	-	-	-	-	-	-	31.37
CO ₂	47.30	-	-	-	-	-	-	-	46.70

	10	11	12	13	14	15	16	17	18
MgO	21.79	20.44	21.70	20.75	20.66	19.51	20.51	19.41	19.53
R ₂ O ₃ ^{a/}	.02	.24	.70	.56	1.13	1.81	1.66	1.03	1.00
SiO ₂	-	.40	.74	.69	1.39	1.18	1.02	.85	1.04
CaO	31.04	31.70	31.73	31.79	31.48	31.66	31.15	30.99	30.70
CO ₂	47.35	-	-	-	-	-	-	-	-

a/ Fe₂O₃ and Al₂O₃. b/ Includes SiO₂. c/ FeO.

TABLE 7. - Analyses of dolomites from the Western States (Cont'd.)

	19	20	21	22	23	24	25	26	27
MgCO ₃	-	-	44.35	-	-	-	42.07	41.40	43.22
MgO	18.68	20.13	-	21.69	20.19	19.19	-	-	-
R ₂ O ₃ ^{a/}	2.38	4.46	.37	-	c/1.89	c/.95	.35	.28	.22
SiO ₂	2.09	1.53	.14	.53	.31	7.18	.28	.22	.20
CaCO ₃	-	-	56.14	-	-	-	55.82	56.75	56.00
CaO	30.14	30.65	-	30.6	30.85	28.52	-	-	-
CO ₂	-	-	-	47.13	47.21	44.09	-	-	-

	28	29	30	31	32	33	34	35	36
MgCO ₃	41.07	41.97	42.37	-	-	-	-	-	-
MgO	-	-	-	18.68	19.52	20.78	18.65	20	19.65
R ₂ O ₃ ^{a/}	.20	.38	.24	b/6.98	.40	.80	b/3.11	b/2	.41
SiO ₂	.78	.20	.24	-	.82	1.52	-	-	.47
CaCO ₃	55.09	56.20	56.20	-	-	-	-	-	-
CaO	+	-	-	29.98	32.54	30.10	31.65	31	31.79

MgO	d/19.71	a/19.35	a/19.50	a/20.55	a/21.89	d/20.11	d/19.46	d/20.29	d/20.29
-----	---------	---------	---------	---------	---------	---------	---------	---------	---------

	46	47	48	49	50	51	52	53	54
MgCO ₃	-	-	-	43.23	40.06	-	-	-	-
MgO	18.92	20.08	21.10	-	-	20.18	20.30	19.19	20.03
R ₂ O ₃ ^{a/}	-	-	.31	2.61	4.10	.46	1.01	.29	1.14
SiO ₂	-	-	1.00	.98	2.66	1.70	7.58	.58	7.94
CaCO ₃	-	-	-	53.18	53.18	-	-	-	-
CaO	-	-	-	-	-	30.87	27.32	30.24	27.33
CO ₂	-	-	-	-	-	46.65	43.03	45.57	42.75

a/ Fe₂O₃ and Al₂O₃ only. b/ Includes SiO₂. c/ FeO. d/ Analyzed for MgO

TABLE 7. - Analyses of dolomites from the Western States (Cont'd.)

	55	56	57	58	59	60	61	62	63
MgCO ₃	-	-	43.79	44.43	44.30	42.54	43.14	..	-
MgO	20.52	20.47	-	-	-	-	-	19.31	20.11
R ₂ O ₃ ^{a/}	.75	-	.76	.90	.40	.98	.58	.99	.41
SiO ₂	5.26	-	3.54	.80	1.72	2.72	.90	4.65	3.15
CaCO ₃	-	-	52.50	54.08	53.72	52.83	55.50	-	-
CaO	28.34	30.05	-	-	-	-	-	31.96	31.55
CO ₂	44.07	-	-	-	-	-	-	43.54	43.91

	64	65	66	67	68	69	70	71	72
MgCO ₃	-	-	-	-	-	-	43.63	42.62	-
MgO	21.15	19.02	20.28	20.68	22.21	20.52	-	-	19.93
R ₂ O ₃ ^{a/}	.41	.63	1.23	-	-	-	.22	.4	.46
SiO ₂	3.98	.82	3.91	.91	.98	-	.34	1.78	.43
CaCO ₃	-	-	-	-	-	-	54.54	54.54	-
CaO	33.07	32.77	30.99	31.80	30.08	32.84	-	-	31.72
CO ₂	41.19	46.73	43.72	46.64	46.70	46.60	-	-	46.91

	73	74	75	76	77	78	79	80	81
MgO	20.25	19.54	19.07	20.41	21.16	20.78	21.52	20.05	21.23
R ₂ O ₃ ^{a/}	.43	.63	.94	.58	.64	.26	.26	.12	.48
SiO ₂	1.75	3.81	4.54	1.50	.68	.7	.27	7.76	.34
CaO	31.50	30.11	29.69	30.54	30.78	30.43	29.97	27.26	30.64
CO ₂	43.17	44.78	44.27	46.03	46.65	46.93	47.39	43.79	46.88

a/ Fe₂O₃ and Al₂O₃.

TABLE 7. - Analyses of dolomites from the Western States (Cont'd.)

	82	83	84	85	86	87	88	89	90
MgO	19.85	21.14	21.32	20.47	20.94	19.69	20.64	20.9	20.15
R ₂ O ₃ ^{a/}	c/1.84	.72	1.02	-	.22	1.63	.88	1.31	1.50
SiO ₂	1.78	.21	.34	1.98	.16	.8	.52	.84	.78
CaO	29.83	30.79	29.84	30.19	30.66	31.19	31.16	30.46	30.55
CO ₂	46.18	46.84	45.18	46.52	47.13	46.16	47.19	46.92	47.04

	91	92	93	94	95	96	97	98	99
MgO	19.75	20.19	20.76	20.32	20.85	19.85	19.44	20.46	20.9
R ₂ O ₃ ^{a/}	1.67	1.50	.22	.35	.42	.36	.08	-	.8
SiO ₂	.65	2.80	.53	-	-	1.12	.24	-	2.4
CaO	30.90	29.35	31.17	30.62	30.43	31.51	32.95	31.28	30.4
CO ₂	47.02	45.00	47.75	46.92	47.10	45.66	47.26	45.68	47.5

	100	101	102	103	104	105	106	107	108
MgO	20.0	21.3	20.6	21.1	20.3	21.1	21.1	20.8	20.9
R ₂ O ₃ ^{a/}	.8	.8	2.05	.85	1.95	.95	1.1	1.3	2.65
SiO ₂	.4	.6	1.0	.4	1.4	.6	.8	.8	2.0
CaO	30.9	30.9	30.6	32.2	32.0	31.7	31.8	31.8	30.6
CO ₂	45.9	43.9	46.3	43.2	47.1	47.8	47.8	47.5	46.7

	109	110	111	112	113	114	115	116	117
MgO	20.3	20.7	20.3	20.2	21.11	20.22	21.00	21.31	20.58
R ₂ O ₃ ^{a/}	1.1	1.95	1.15	2.15	-	-	-	-	-
SiO ₂	.6	1.4	.6	1.6	-	-	-	-	-
CaO	32.2	31.2	32.5	32.1	31.40	31.98	31.52	31.44	32.32
CO ₂	47.2	47.0	47.5	47.0	46.40	46.60	47.13	47.07	47.40

a/ Fe₂O₃ and Al₂O₃. c/ FeO.

TABLE 7. - Analyses of dolomites from the Western States (Cont'd.)

	118	119	120	121	122	123	124	125	126
MgO	20.66	19.77	20.12	19.68	20.46	21.63	21.55	22.28	22.22
SiO ₂	-	6.00	7.32	-	5.42	-	.20	6.59	.10
CaO	32.16	29.28	29.76	32.56	29.90	30.70	31.00	36.20	31.80
CO ₂	47.45	43.70	44.44	46.63	44.65	47.13	47.13	34.77	43.48

Locations of samples in table 7

1. Hamilton deposit near Hollister, San Benito County, Calif.
- 2-5. Crow deposit near Hollister, San Benito County, Calif.
6. Natural Soda Products Co., Keeler, Inyo County, Calif.
7. Zurich, Inyo County, Calif.
8. Marble from Inyo County, Calif.
9. Live Oak Spring, San Diego County, Calif.
10. Near Keeler, Inyo County, Calif.
11. 15 miles northeast of Arroyo Grande, San Bernardino County, Calif.
- 12,13. Marble Canyon, Inyo Range, northeast corner of Bishop quadrangle, Inyo County, Calif.
14. Antelope Creek, Inyo Range, northeast corner of Bishop quadrangle, Inyo County, Calif.
- 15-20. Wyman Creek, Inyo Range, northeast corner of Bishop quadrangle, Inyo County, Calif.
21. Dolomitic portion of deposit at Sloan, Clark County, Nev.
22. Eureka, Eureka County, Nev.
- 23,24. Silver Peak, Esmeralda County, Nev.
25. Diamond drill hole "A", 1,693 feet, Eureka Corporation, Ltd., Eureka, Eureka County, Nev.
26. Diamond drill hole "A", 2,006 feet, Eureka Corporation, Ltd., Eureka, Eureka County, Nev.
- 27,28. Hamburg Mine, Pioche district, Lincoln County, Nev.
- 29,30. Pioche, Lincoln County, Nev.
31. 6-foot bed near top of Kaibab limestone, Bass Trail, west of El Tovar, Coconino County, Ariz.
32. Lower 80 feet of Redwall limestone, Bass Trail, west of El Tovar, Coconino County, Ariz.
33. Upper 60 feet of Muav limestone, Bass Trail, west of El Tovar, Coconino County, Ariz.
34. Lower division of Martin limestone, central and southern Ariz.
35. Near Castle Hot Springs, Yavapai County, Ariz.
36. Grand Canyon, Ariz.
37. Tassai Ridge, below Pierce Ferry on Lake Mead, Mohave County, Ariz., 800-850 feet above lake level.
38. Tassai Ridge, below Pierce Ferry on Lake Mead, Mohave County, Ariz., 850-950 feet above lake level.

Locations of samples in table 9 (Cont'd.)

39. Tassai Ridge, below Pierce Ferry on Lake Mead, Mohave County, Ariz., 950-1100 feet above lake level.
40. Tassai Ridge, below Pierce Ferry on Lake Mead, Mohave County, Ariz., 1,100-1,350 feet above lake level.
41. Tassai Ridge, below Pierce Ferry on Lake Mead, Mohave County, Ariz., 1,350-1,550 feet above lake level (partial analysis).
42. East of Peach Springs, U. S. Highway 66, 35 feet of Redwall dolomite.
43. East of Peach Springs, U. S. Highway 66, 8-foot bed of Redwall dolomite a few feet higher than 42.
44. One mile east of Peach Springs on Santa Fe Railroad, 65 feet of Redwall dolomite.
45. Six miles south of Seligman, Yavapai County, Ariz., 80-foot series, Redwall dolomite.
46. Upper Chino Valley, 9 miles north of Del Rio, Yavapai County, Ariz., Devonian limestone.
47. North side of Humbug Creek, 38 miles north of Marinette, Maricopa County, Ariz., 25 feet of dolomite.
48. El Capitan Peak, Guadalupe Mountains, Culberson County, Tex.
49. 18 miles northwest of Carlsbad, Eddy County, N. Mex., 15-foot bed at top of Rocky Arroyo.
50. 13 miles north of Carlsbad, sec. 2, T. 21 S., R. 25 E., Eddy County, N. Mex., 7-foot bed.
- 51-55. Dolomite from government test hole No. 18, Carlsbad formation, Eddy County, N. Mex.
56. Dolomitic Permian limestone 20 miles west of Carlsbad, Eddy County, N. Mex.
- 57-61. On Colorado River near Colville, Stevens County, Wash.
62. West of Orient, Ferry County, Wash., small deposit.
63. Near Chewelah, Stevens County, Wash.
- 64-66. Near Colville, Stevens County, Wash.
- 67,68. Near Addy, on Stranger Creek, Stevens County, Wash.
69. Wallowa Mountains, Oreg.
70. Lewis and Clark County, Mont., north of East Gallatin River.
71. Lewis and Clark County, Mont., west of North Boulder River.
72. Madison limestone from north end of Big Horn Canyon, south of Hardin, Big Horn County, Mont.
73. Utah Lime & Stone Co., near Grantsville, Tooele County, Utah.
- 74-76. Park City district, Summit County, Utah.
77. San Francisco District, Summit County, Utah.
78. Dugan quarry, Leadville, Lake County, Colo.
79. Glass-Pendery mine, Leadville, Lake County, Colo.
80. Montgomery quarry, Leadville, Lake County, Colo.
81. Leadville limestone, Lake County, Colo.
82. Dolomite in Weber formation, Lake County, Colo.
83. Upper Blue limestone, Silver Wave mine, Leadville, Lake County, Colo.
84. Blue limestone, Leadville, Lake County, Colo.
85. Mount Silverheels, Park County, Colo.
- 86,87. Pitkin County, Colo.
- 88,89. Aspen, Pitkin County, Colo.

Locations of samples in table 7 (Cont'd.)

- 90,91. Tenmile District, Summit County, Colo.
 92. Bull Lake, Wind River Range, Wyo.
 93. Labarge Mountain, Green River Valley, Wyo.
 94. Shoal Creek, Gros Ventre Range, Wyo.
 95. Leigh Creek, Teton Range, Wyo.
 96. Black Hills, Wyo.
 97. Hunt Mt., Bighorn district, Wyo.
 98. Base of Spearfish formation, northern Black Hills, Wyo.
 99-102. Near Cody, Park County, Wyo.
 103-108. Nine miles west of Thermopolis, Hot Springs County, Wyo.
 109-111. Thirteen miles north of Shoshoni, Fremont County, Wyo.
 112. Ten miles southwest of Casper Mountain, Natrona County, Wyo.
 112-118. Goodsprings quadrangle, Clark County, Nev., Anchor limestone.
 119-122. Goodsprings quadrangle, Clark County, Nev., Bird Spring formation.
 123-125. Goodsprings quadrangle, Clark County, Nev., dolomitized Monte Cristo limestone.
 126. Goodsprings quadrangle, Clark County, Nev., dolomite.

SELECTED BIBLIOGRAPHY

- BASTIN, E. S. Lime Industry of Knox County, Maine. Geol. Survey Bull. 285j, 1906, pp. 393-400.
 BEACH, J. O., and ENGLISH, S. G. Dolomite and Magnesium Limestone. Oklahoma Geol. Survey Mineral Rept. 6, 1940, 18 pp.
 BEVAN, A. Memorandum on Dolomite in Virginia. (Unpublished notes.) Virginia Geol. Survey, 1942, 6 pp.
 BLATCHERLY, W. S. The Lime Industry in Indiana. Indiana Geol. Survey Ann. Rept. 28, 1903, pp. 211-257.
 BOWLES, OLIVER. The Stone Industries, 2d ed., New York, 1939, pp. 396-452.
 ——— The Structural and Ornamental Stones of Minnesota. Geol. Survey Bull. 663, 1918, p. 149.
 BRIDGE, JOSIAH. Geology of the Eminence and Cardareva Quadrangles. Missouri Bureau of Geol. and Mines, vol. 24, 2d ser., 1930, pp. 67-128.
 BUEHLER, H. A. Lime and Cement Resources of Missouri. Missouri Bureau of Geol. and Mines, vol. 6, 2d ser., 1907, pp. 95-241.
 BURCHARD, E. F. Concrete Materials Produced in the Chicago District. Geol. Survey Bull. 340, 1908, pp. 383-411.
 BURCHARD, E. F., and BUTTS, CHARLES. Iron Ores, Fuels, and Fluxes in the Birmingham District, Alabama. Geol. Survey Bull. 400, 1910, 204 pp.
 BUTTS, CHARLES. Limestone and Dolomite in the Birmingham District. Geol. Survey Bull. 315g, 1906, pp. 247-255.
 ——— Dolomite for Flux in the Vicinity of Montevallo, Shelby County, Ala. Geol. Survey Bull. 470, 1911, pp. 525-527.
 CALIFORNIA DIVISION OF MINES. Dolomite in California. (Unpublished abstract.) 1942.
 CLARKE, F. W. Analyses of Rocks from the Laboratory of the United States Geological Survey. Geol. Survey Bull. 163, 1900, p. 258.
 ——— Analyses of Rocks and Minerals from the Laboratory of the United States Geological Survey. Geol. Survey Bull. 591, 1915, 376 pp.

- The Data of Geochemistry. Geol. Survey Bull. 770, 1924, pp. 565-580.
- COLBY, SHIRLEY F. Occurrences and Uses of Dolomite in the United States. Bureau of Mines Inf. Circ. 7192, 1941, 21 pp.
- CULLEN, JOHN. Lime Resources and Industry in Oklahoma. Oklahoma Geol. Survey Bull. 26, 1917, 70 pp.
- CUMINGS, E. R. and SHROCK, R. R. The Geology of the Silurian Rocks of Northern Indiana. Indiana Div. of Geol. Pub. 75, 1928, pp. 94-109, 135-138, 168-178.
- CUNNINGHAM, W. A. Dolomite in Permian Limestones of West Texas. Bull. Am. Assoc. Petrol. Geol., vol. 19, No. 11, 1935, pp. 1678-1692.
- DAKE, C. L. Geology of the Potosi and Edgehill Quadrangles. Missouri Bureau of Geol. and Mines, vol. 23, 2d ser., 1930, pp. 51-191.
- DALE, T. N. The Commercial Marbles of Western Vermont. Geol. Survey Bull. 521, 1912, 170 pp.
- The Calcite Marble and Dolomite of Eastern Vermont. Geol. Survey Bull. 589, 1915, 67 pp.
- The Lime Belt of Massachusetts and Parts of Eastern New York and Connecticut. Geol. Survey Bull. 744, 1923, 71 pp.
- DANA, E. S. A Textbook of Mineralogy. 4th ed., revised by W. E. Ford, New York, 1932, p. 516.
- DARTON, N. H., and PAIGE, S. Central Black Hills, S. Dak. Geol. Survey Folio 219, 1925.
- DOTT, R. H. Dolomites in Oklahoma. (Unpublished manuscript.) Oklahoma Geol. Survey, 1942, 5 pp. 2 maps.
- ECKEL, E. C. Portland Cement Materials and Industry in the United States. Geol. Survey Bull. 522, 1913, 401 pp.
- GORDON, C. H., DALE, T. N., and BOWLES, O. Marble Deposits. Tennessee Geol. Survey Bull. 28, 1924, p. 35.
- GRIMSLEY, G. P. Geology of Jefferson, Berkley, and Morgan Counties. West Virginia Geol. Survey County Repts., 1916, pp. 106-135, 254-320.
- HOPKINS, T. C. Marbles and Other Limestones. Arkansas Geol. Survey Ann. Rept., No. 4, 1890, pp. 34, 115-125.
- JENKINS, O. P. Phosphates and Dolomites of Tennessee. Tennessee Geol. Survey, vol. 6, No. 2, 1916, pp. 51-106.
- JEWETT, J. M., and SCHOEWE, W. H. Kansas Mineral Resources for Wartime Industries. Kansas Geol. Survey Bull. 41, 1942, pp. 104-112.
- KNIGHT, N. Some Iowa Dolomites. Am. Jour. Sci., 4th ser. vol. 2, 1901, p. 244.
- The Dolomites of Eastern Iowa. Am. Geol., vol. 34, July, 1904, p. 64.
- KREY, F., and LAMAR, J. E. Limestone Resources of Illinois. Illinois Geol. Survey Bull. 46, 1925, 392 pp.
- KUMMEL, H. B. The Chemical Composition of the White Crystalline Limestones of Sussex and Warren Counties. New Jersey Geol. Survey Ann. Rept., pt. III, 1905, pp. 175-191.
- LA FORGE, L. Ellijay, Ga. - N. C. - Tenn. Geol. Survey Folio 187, 1913, 18 pp.
- LEE, W. Geology of the Rolla Quadrangle. Missouri Bureau of Geol. and Mines, 2d ser., vol. 12, 1913, pp. 12-40.
- LEIGHTON, M. M. High-purity Dolomite Resources of Illinois. Notes furnished by Illinois Geol. Survey, 1942, 8 pp., 2 maps.

- LOUGHLIN, G. F., BERRY, E. W., and CUSHMAN, J. A. Limestones and Marls of North Carolina. North Carolina Geol. Survey Bull. 28, 1921, 211 pp.
- McCALLIE, S. W. Marbles of Georgia. Georgia Geol. Survey Bull. 1, 1907, p. 109.
-
- A Preliminary Report on the Mineral Resources of Georgia. Georgia Geol. Survey Bull. 23, 1910, 208 pp.
- McCUE, J. B., LUCKE, J. B., and WOODWARD, H. P. Limestone of West Virginia. West Virginia Geol. Survey Bull., vol. 12, 1939, pp. 74-117, 375-500.
- MARBUT, C. F. Geology of Morgan County. Missouri Bureau of Geol. and Mines, 2d ser., vol. 7, 1907, pp. 24-46, 66-94.
- MATHEWS, E. B., and GRASTY, J. S. Limestones of Maryland. Maryland Geol. Survey Bull., vol. 9, 1910, pp. 338-397.
- MILLER, B. L. Limestones of Pennsylvania. Pennsylvania Geol. Survey Bull. M 20, 4th ser., 1934, 729 pp.
- MOORE, F. H. Marbles and Limestones of Connecticut. Connecticut Geol. Survey Bull. 56, 1935, 56 pp.
- MOSSOM, S. Preliminary Report on the Limestones and Marble of Florida. Florida Geol. Survey 16th Ann. Rept., 1925, pp. 27-203.
- NEWLAND, D. H. The Quarry Materials of New York - Granite, Gneiss, Trap, Marble. New York State Mus. Bull. 181, 1916.
- ORTON, EDWARD, JR., and PEPPEL, S. V. The Limestone Resources and the Lime Industry in Ohio. Ohio Geol. Survey Bull. 4, 4th ser., 1906, pp. 19-158.
- REED, B. B., and KNIGHT, N. Some American Dolomites. Proc. Iowa Acad. Sci., vol. 26, 1919, pp. 377-378.
- RICHARDSON, G. B. Portland Cement Materials near El Paso, Tex. Geol. Survey Bull. 340, 1908, pp. 411-414.
- RIES, H. The Limestone Quarries of Eastern New York, Western Vermont, Massachusetts, and Connecticut. Geol. Survey Ann. Rept., pt. III, No. 17, 1896, p. 796.
- RIES, H., and ECKEL, E. C. Lime and Cement Industries of New York. New York State Mus. Bull. 44, pp. 641-968.
- SHEDD, S. Cement Materials and Industry in the State of Washington. Washington Geol. Survey Bull. 4, 1913.
- SMITH, J. E. The Fertilizer Materials of Iowa. Iowa Geol. Survey Ann. Rept., vol. 31, 1923-1924, pp. 97-148.
- SMITH, R. A. Limestones of Michigan. Michigan Geol. and Biol. Survey Pub. 21, pt. II, 1916, pp. 109-311.
- STAUFFER, C. R., and THIEL, G. A. Limestones and Marls of Minnesota. Minnesota Geol. Survey Bull. 23, 1933, 193 pp.
-
- Paleozoic and Related Rocks of Southeastern Minnesota. Minnesota Geol. Survey Bull. 29, 1941, 261 pp.
- STEIDTMANN, EDWARD. Limestones and Marls of Wisconsin. Wisconsin Geol. Survey Bull. 66, 1924, pp. 6-96.
- STOUT, WILBUR. Dolomites of Ohio. (Unpublished analyses.) Ohio Geol. Survey, 1942, 330 pp.
- SUFFEL, G. G. Dolomites of Western Oklahoma. Oklahoma Geol. Survey Bull. 49, 1930, 155 pp.
- THOMAS, H. D. Memorandum on the Occurrence of Dolomite in Wyoming. (Unpublished memorandum.) Wyoming Geol. Survey, 1942, 8 pp., 1 map.

- TREMOUREUX, R. E. Quarrying Methods and Costs at the Sloan Quarry of the U. S. Lime Products Corporation, Sloan, Nev. Bureau of Mines Inf. Circ. 6599, 1932, 8 pp.
- VAN TUYL, F. M. The Occurrence of Dolomite. Colorado Sch. Mines Mag., vol. 14, No. 11, 1925, p. 14.
- WELLER, STUART, and ST. CLAIR, STUART. Geology of Ste. Genevieve County. Missouri Bur. of Geol. and Mines, 2d ser., vol. 22, 1928, pp. 34-120.
- WELLS, R. C. Analyses of Rocks and Minerals from the Laboratory of the United States Geological Survey. Geol. Survey Bull. 878, 1937, 134 pp.
- WHEELER, H. E. Revisions of Cambrian Stratigraphy in the Pioche District, Nevada. Nevada Univ. Bull., vol. 33, No. 3, 1939, 60 pp.
- WILLIAMS, I. A., and BEYER, S. W. Analyses of Iowa Limestones and Chalks. Iowa Geol. Survey Ann. Rept., vol. 17, 1906, p. 531.
- WILSON, E. D. Dolomite in Arizona. (Unpublished manuscript.) Arizona Bureau of Mines, 1942, 9 pp., 1 map.